

Analysis of Industrial Sector Competitiveness of Pakistan: An Application of Panzar-Rosse (PR-H) Statistic

Muhammad Sohail¹, Muhammad Idrees² and Muhammad Tariq Majeed³

<https://doi.org/10.62345/jads.2024.13.1.33>

Abstract

This study utilizes the Panzar-Rosse (1978) PR-H Statistics framework to examine the competitiveness of Pakistan's industrial sector. Leveraging data from the Pakistan Stock Exchange (PSX) covering the period from 2007 to 2020 and focusing on insights from the 200 largest listed companies, our study sheds light on the complex market dynamics and competitive forces at play in the sector. By applying the Panzar-Rosse PH Statistic, we aim to demonstrate the presence of a competitive market structure that helps mitigate monopolistic tendencies. Our analysis, while managing endogeneity and employing the Generalized Method of Moments, reveals that the industrial sector in Pakistan is characterized by significant market dynamics that influence business behavior and performance. Despite this, the results of the PR-H Statistics suggest a relatively competitive market environment prevailing in Pakistan's industrial sector. However, there are indications of non-competitive behaviors attributed to weak institutional quality and the overall economic conditions of the country. Additionally, tendencies of weak and imperfect market structures are prevalent, compounded by undocumented and informal economic activities. Through this investigation, we aim to deepen understanding of the competitive landscape in Pakistan's industrial sector and its implications for industrial agents. By highlighting the challenges posed by non-competitive behaviors and weak market structures, our study offers valuable insights into the broader economic ecosystem of Pakistan.

Keywords: Industrial Competitiveness, Panzar-Rosse PR-H Statistics, Market Structure, GMM, Pakistan Stock Exchange.

Introduction

Industrial competitiveness plays a pivotal role in driving economic growth and development, necessitating the implementation of effective government policies to foster a conducive environment for industrialization. Drawing insights from the experiences of Newly Industrialized Countries (NICs) at micro and macro levels offers valuable lessons for enhancing industrial competitiveness. However, analyzing the competitiveness of manufacturing sectors presents challenges due to the need for more pertinent data concerning Pakistan and its comparable economies. This paper uses theoretical and empirical models to scrutinize Pakistani manufacturing firms' competitiveness on the Pakistan Stock Exchange (PSE).

¹PhD Economics Scholar, School of Economics, Quaid-i-Azam University, Islamabad.

Corresponding Author Email: m.iiui60@gmail.com

² Professor, School of Economics, Quaid-i-Azam University, Islamabad. Email: midrees@qau.edu.pk

³ Professor & Director, School of Economics, Quaid-i-Azam University, Islamabad. Email: tariq@qau.edu.pk



A critical aspect of achieving competitiveness lies in empirically evaluating the impact of industrial and government policies supported by robust theoretical frameworks. Accordingly, this study will furnish theoretical underpinnings and empirical analyses utilizing relevant data and models. Guided by literature on economic development, industrial policies, and manufacturing sector competitiveness, the study seeks to address existing gaps by incorporating factors from the demand, supply, and policy domains. While prior research, such as that by Ara (2004), has explored aspects of competitiveness, this study seeks to expand the scope by incorporating a broader range of factors affecting industrial sector competitiveness (Dunning & Narula, 2005).

Competitiveness manifests at various levels, including firm, industry, and national levels, with this study focusing primarily on individual firm-level analysis. Recognizing that the survival of national industrial sectors hinges on the collective competitiveness of firms in international markets, this study adopts a granular approach. At the firm level, competitiveness is construed as the ability to compete domestically and internationally effectively, encompassing price and non-price factors such as marketing, production, finance, and cost management strategies (Kleynhans, 2016). The declining trend in manufacturing production witnessed in Pakistan over recent decades underscores the urgency of this inquiry amidst concerns of deindustrialization attributed to firms' lack of competitiveness.

In globalization and economic integration, the structural dynamics of economies undergo profound transformations, intensifying competition for both nations and firms. These shifts in economic and political landscapes, both domestically and internationally, significantly impact manufacturing sector performance. As evidenced by literature and empirical observations, the development of the manufacturing sector serves as a linchpin for fostering economic prosperity, necessitating a deeper understanding of factors influencing industrial competitiveness (Oral, 1986).

Building upon the discussion above on the dynamics of industrial competitiveness and the methodologies employed, this study aims to achieve two primary objectives. Firstly, it seeks to assess the competitiveness within the industrial sector of Pakistan by utilizing the Panzar-Rosse PR-H Statistics. By employing this analytical tool, the study provides insights into the competitive landscape of the industrial Pakistani industry, shedding light on the extent to which market structures adhere to competitive principles. Secondly, in line with the broader aim of informing policymaking, the study aims to derive policy recommendations grounded in the empirical findings. Through a synthesis of theoretical frameworks, empirical analyses, and the identification of competitive factors, this study aspires to offer actionable insights for policymakers to enhance the competitiveness of Pakistan's industrial sector.

Objectives of the Study

1. To determine the competitiveness in the industrial sector of Pakistan using Panzar-Rosse PR-H Statistics.
2. To provide policy recommendations based on our results.

Significance of the Study

This study is essential because it provides insights into the level of competitiveness in Pakistan's industrial sector. We thoroughly understand the competitive landscape in Pakistan's numerous industries using rigorous statistical approaches such as PH statistics. This knowledge is vital to stakeholders, including politicians, enterprises, and investors, since it allows them to make educated decisions based on a clear understanding of market dynamics and competitive forces. By thoroughly examining competition levels, this study enables policymakers to develop targeted

policies and regulatory frameworks to encourage a more competitive corporate climate. Such initiatives include policies to reduce barriers to entry, promote innovation, and enhance market efficiency, stimulating greater competition and driving economic growth.

For businesses operating within Pakistan's industrial sector, the insights gleaned from this research serve as a strategic guidepost for refining their competitive strategies and positioning themselves effectively within the market. Armed with a better understanding of the competitive landscape, businesses can identify areas of opportunity, anticipate competitive threats, and make informed decisions to enhance their market position and profitability. Moreover, investors stand to benefit from the findings of this study by gaining a deeper insight into the competitive dynamics of Pakistan's industrial sector. This knowledge allows investors to make more informed investment decisions, allocate resources effectively, and mitigate risks associated with competitive markets. Furthermore, the study goes beyond merely diagnosing the current state of competitiveness and offers valuable recommendations for policymakers on further enhancing Pakistan's industrial sector competitiveness. Suggestions include strengthening regulatory frameworks, incentivizing investment in research and development, and promoting entrepreneurship and innovation. Overall, this research strengthens Pakistan's economy and fosters sustainable economic growth. By shedding light on the determinants of competitiveness and offering actionable insights, the study paves the way for strategic interventions to enhance the resilience, dynamism, and competitiveness of Pakistan's industrial sector, ultimately leading to a stronger and more stable economy.

Literature Review

In this section, we will examine the literature on the notion of industrial competitiveness, looking at different views and perspectives scholars offer. By summarizing earlier research findings, we aim to clarify competitiveness and its relationship with industrial development and economic growth.

Nature of Competitiveness

The concept of competitiveness has changed suggestively since the 1990s, after the advent of globalization, the opening up of economies, and the emergence of new markets worldwide. Through globalization, economies have become interdependent, and competition among industries and firms has intensified (Dunning & Narula, 2005). The competitiveness of firms and industries has been increasingly important in securing most world markets to spearhead industrialization. Moon et al. (2000) have emphasized the role of competitiveness in shaping industrialization and industrial development. Competitiveness is critical in non-industrialized economies that aim to catch up with the industrialized economies (Sirikrai & Tang, 2006).

Earlier, it was assumed that competitiveness was primarily a firm-level strategy allowing the business to retain its presence on the market. However, over the last three decades, it has become central to the work of economists and central banks and has developed into a sophisticated and multidimensional concept (Zhang, 2014). As a result of such intensive application, the idea has become complex, with researchers exploring its multiple sides and uses. The section below will offer a brief view of the early literature associated with competitiveness and related concepts.

According to the OECD, competitiveness entails sustaining relatively high factor income and employment by firms, industries, companies, and nations (Considine et al., 2001). Various institutions, such as the International Institute of Management Development (IMD), the United States Competitiveness Policy Council, and the World Economic Forum (WEF) share common points regarding competitiveness and its definitions. They all emphasize that effective competitive

ability leads to high income or rewards. Moreover, competitive ability is recognized as dynamic, varying over time, and intertwined with income levels. The current domestic and international competitive environment has raised questions about the measurement of competitiveness. As competitiveness varies across nations, countries, and firms, it is perceived as flexible and diffuse (Lall, 2003; Sirikrai & Tang, 2006).

The competitive advantage of a nation or industry catalyzes accelerated industrialization, with competitiveness being the outcome of creating such an advantage. However, the relationship between these two concepts is complex. Competitiveness encompasses a multitude of factors and various types of competitive benefits, leading to a potential divergence between the two, as discussed by (Ezeala-Harrison, 1999; Kennedy & Harrison, 1999)

Competitions manifest at different levels, from individual firms to entire economies, necessitating a comprehensive exploration of competitiveness across all levels. At the firm level, competitiveness refers to the ability of a firm to thrive in a market and achieve sustained productivity and profitability over time (Oral, 1986). This definition has garnered consensus within industrial and business literature and can be readily extended to assess competitiveness at the industrial sector and national levels.

The concept of national competitiveness, as delineated by (Porter et al., 2001), is subject to scrutiny. Porter defines competitiveness as productivity, which some argue is a determining factor rather than a true proxy of competitiveness itself. The definition of national competitiveness has sparked intense debate due to its ambiguities and challenges. While competitiveness can be effectively analyzed at the firm and industry levels, its application at the national level is contentious. Krugman (1994) asserts that treating a country as a company lacks validity, emphasizing the inherent differences between the two. This viewpoint was challenged by (Prestowitz, 1994). In conclusion, competitiveness is a complex and nuanced concept that warrants careful consideration and analysis.

The determinants of competitiveness are subject to controversy, mirroring the complexity of the concept itself. Economists lack consensus regarding the factors that influence competitiveness, making it challenging to identify a comprehensive range of determinants (Browne, 2012; UNIDO, 2023). Competitiveness and its determinants can be examined at both micro and macro levels, further complicating the issue and clarifying the subject (Ezeala-Harrison, 1999; Moon & Cho, 2000).

Supply-side and demand-side factors play crucial roles in shaping productivity and competitiveness. Unique capabilities inherent to individual firms also serve as key determinants, conferring competitive advantages that others cannot easily replicate (Kay, 2014). Factors such as raw materials, technology, and knowledge spillovers significantly influence an economy's competitiveness.

An alternative approach to understanding competitiveness is through a direct perspective, emphasizing factors such as natural resources, firm location, and agricultural considerations. High technological levels, skilled human capital, and robust research and development (R&D) capabilities contribute to sustained competitiveness and technological progress (Porter, 1999).

Numerous studies have explored various factors contributing to competitiveness, including advancements in knowledge, innovations, patents, trademarks, copyrights, R&D investments, and improved software utilization (Ezeala-Harrison, 1999; Kay, 2014; Morris, 2002; Quinn, 1992). On the demand side, Porter's diamond model highlights domestic demand's significance as a competitive driver. A massive requirement for products leads to enhancing the economy's efficiency, which improves the links with other states from a competitive perspective.

Porter's diamond model, as proposed in 1990 and 1998, underscores the role of a robust value chain in driving competitiveness. Within this model, supporting and related industries collaborate to create competitive advantages for larger firms, thus enhancing overall industry competitiveness. Porter also highlights the significance of firm-level strategies in fostering competitiveness, such as market-capturing tools and rivalry with other firms. Moreover, he argues that inefficient business and production techniques can spur innovation and drive the adoption of more efficient practices.

Wong, (2003) support Porter's notion that education and technological advancement are pivotal determinants of competitiveness. However, some critics argue that Porter's model overlooks the role of foreign direct investment (FDI) and government intervention in industrialized countries (Moon & Cho, 2000; Moon et al., 1998). Furthermore, Porter's diamond model needs help to explain competitiveness in advanced developed countries.

These limitations prompted (Moon & Cho, 2000) to propose an extended model that incorporates the role of government as a determinant of competitiveness, unlike Porter's model. Cho's model employs nine factors, including human and physical resources, to capture competitiveness across four development stages. However, a notable drawback of Cho's model is its reliance on the industrial experience of Korean economies, needing more empirical evidence for its applicability to developing and developed countries.

In conclusion, analyzing competitiveness can begin at the firm level before expanding to the industry and national levels. Similarly, such analysis can be conducted across various manufacturing sectors and spatially, encompassing provinces and economic zones (Porter, 1990a, 1990b). Given the contentious nature of competitiveness in the literature on manufacturing and industrialization, careful consideration is warranted when conducting such analyses.

Theoretical Framework

From the synthesis of earlier literature, it becomes apparent that competitiveness can be examined from three distinct perspectives: at the firm, industry, and national levels. While previous analyses have often focused on specific indicators pertinent to firm-level competitiveness, it is crucial to acknowledge competitiveness as a multi-dimensional phenomenon, as noted by (Sercovich et al., 1999). Competitiveness can be assessed through various lenses: firstly, by scrutinizing the operational mechanisms of firms, including their production and management methods, quality, cost efficiency, and innovation capabilities. Secondly, by evaluating the availability and utilization of physical and human capital and the adoption of new and advanced technologies to bolster firm capabilities. Thirdly, competitiveness can be gauged through firms' economic and financial performance, with firm expansion serving as a valid indicator at the micro-level (Schaeck & Čihák, 2008).

However, defining competitiveness at the macro level presents challenges, Sercovich et al. (1999) proposed a definition that views competitiveness as the accumulation of overall capabilities achieved over previous periods, emphasizing the importance of historical accumulation rather than current capabilities. Different authors have developed various indices to measure competitiveness, such as the Competitive Industrial Performance Index by UNIDO (Lall, 2003) and the OECD index by (Causa & Cohen, 2006). Each index has its contradictions and weaknesses, and overcoming these shortcomings in a single study is difficult.

Nonetheless, manufacturing competitiveness can be ascertained through technological enhancements, linkages between small and large firms, a skilled labor force, and expenditures on research and development (R&D) (Fagerberg, 1996). While various competitiveness indices are

available, the most commonly used indicators include labor and capital productivity, cost efficiency, and total factor productivity. Additionally, combining these factors with others can facilitate the design of a more effective competitiveness index, addressing the limitations of existing indices (Ray & Desli, 1997).

Data and Methodology

The study will utilize data from 200 listed non-financial firms on the Pakistan Stock Exchange from 2007 to 2020. These firms will be categorized into different sub-sectors based on data availability. Following the approach of Márkus and Zs (2007) and Voulgaris and Lemonakis (2014), the study aims to construct an index for the manufacturing sector that captures dynamic changes over time while analyzing specific firm characteristics. However, due to the limited availability of firm-level data in Pakistan, the study will rely on the financial statements of firms listed on the Pakistan Stock Exchange.

Drawing from earlier literature and theories related to manufacturing firms, indicators for constructing the competitiveness index will be selected. According to theory and literature, a competitive firm possesses a significant market share, maintains appropriate profit margins, and exhibits a tendency for growth.

The market structure of industries or manufacturing units can be estimated using the structural approach based on Industrial Organization Theory (IOT) and the nonstructural approach based on the New Empirical Industrial Organization (NEIO) theory. The structural approach utilizes market structure variables such as market share, growth in market share, and concentration ratios to measure competitiveness. Conversely, the NEIO theory, pioneered by (Roy et al., 2006) and further developed by (Bresnahan, 1989) (Bikker et al., 2012; Panzar & Rosse, 1987), employs the competitive behaviors of firms and non-structural factors as indicators of market competition.

Various models have been proposed under the nonstructural approach, including the Iwata model (1974), Baumol (1982) contestable market theory, the (Bresnahan, 1982, 1989), the Lerner index (Kim & Lyn, 1986), the (Shaffer & DiSalvo, 1994), and the Panzar-Rosse H-Statistic (Panzar & Rosse, 1987). The Panzar-Rosse H-Statistic, in particular, is widely used in literature to analyze market structure and competitiveness. The model developed in this study is based on calculating the H statistics, which is defined as the elasticity of revenue concerning cost. If H is equal to 1, the market is perfectly competitive, while $H = 0$ indicates that the market is monopolistic. Furthermore, $H < 0$ refers to a collusive oligopoly, while $H > 1$ is monopolistic. The adopted model ranges from negative to positive infinity. Although the main idea behind calculating the H statistics is to determine the market structure, in this case, it was also used to evaluate the competitiveness of various industries in Pakistan, which was measured by the Panzar-Rosse model (Panzar & Rosse, 1987). Overall, this is an acceptable approach that will be used to evaluate several firm-specific variables before determining their competitiveness.

Table 1: Conditions for competition

H-Statistic	Conditions for Competition	Condition for Equilibrium
$H \leq 0$	Monopoly or Collusive Oligopoly	Non-Equilibrium
$H = 1$	Perfect Competition	
$0 < H < 1$	Monopolistic Competition	

Model PR-H Statistic

The competition is a typical microeconomic construct, which is concerned with the behavior of individual firms within the market. Accordingly, the empirical model, proposed in this work, will also be based on microeconomic concepts, specifically after Panzar-Rosse, albeit slightly reformulated. The shaping of own empirical approach begins with the establishment of profit-maximization and equilibrium conditions for firms operating within the market. Initially, the definitions of revenue and cost functions must be made. In this context, the revenue function models total income of a firm from selling a particular output, while the cost function encompasses all incurred expenses of production. The value of these functions is to be deduced from the market demand, production technology, and prices of inputs (Falciola et al., 2020).

Further, they are to be combined to determine the condition of profit maximization. It allows firms to allocate their resources in an optimal way and achieve the highest profits from output production. If expressed mathematically, the condition works under equality between the revenue function and cost function derivatives, with the first being a marginal revenue, and the second a marginal cost. Further, through the outlined microeconomic conditions, it will be possible to establish various changes in production level of a good and price policy of a firm as a response to the changing market conditions, which will allow the assessment of the actual level of competition within the industry (Makowski, 1982).

The revenue function is as follows

$$REV_i = f(Y_i, P_i) \text{-----} (1)$$

The Cost Function:

$$C_i = f(Q_i, w_i, r_i) \text{-----} (2)$$

Where as

- Y_i = The output of the Specific Firm
- P_i = The price level
- w_i = The Labor income (Wage rate)
- r_i = The rental income associated with capital

Moreover, apart from internal values such as production technology and input prices, there are numerous exogamic variables that can influence both revenue and costs greatly. Thus, firms' profit maximization equation will be able to contain several shift factors. The first reason is the number of competing firms in the industry. The second and the third existing elements are tax rates and subsidizing. Finally, the fourth one is various institutional factors affecting the market.

What is more, we see that when these variables are included in our model, it can better explain the systems of value, on which various enterprises are based. That is why the model's functional form has become more complicated when these exogenous values were included in our study. As a result, the interaction between the function's internal and external determinants is reflected in the dynamically and more involved functional form of our model.

Thus, along with the previous function, our model can also provide information about how changes in market structure, a variety of regulating institutions, and governmental policies may alter firms' revenue and expenses. This expanded model enables us to capture the full spectrum of factors influencing competitiveness within the industry, providing valuable insights for policymakers, industry stakeholders, and researchers alike.

$$REV_i = f(Y_i, P_i, n_i, z_i) \text{-----} (3)$$

$$Cost_i = f(Y_i, w_i, r_i, u_i) \text{-----} (4)$$

Where

- Y_i = Total output produced

- n_i = No of firms
- z_i = Exogenous variables which can affect the revenue function
- u_i = Exogenous variables which can affect the cost function

Using equation (3) and (4), we can write the profit function as follows.

$$\Pr(Y_i, P_i, w_i, r_i, z_i, u_i) = \text{Rev}(Y_i, P_i, n_i, z_i) - \text{Cost}(Y_i, w_i, r_i, u_i) \text{-----} (5)$$

It is necessary for the firm to achieve the maximum profit which can be represented from the following expression which is MR=MC.

$$\text{REV}(Y_i, P_i, n_i, z_i) - \text{Cost}(Y_i, w_i, r_i, u_i) = 0 \text{-----} (6)$$

In the same manner, equilibrium conditions in the market can only be achieved if all the extra profits become zero and every firm is earning normal profits. That can be represented as follows.

* In the below equation attributes to the equilibrium of each variable in the market.

$$\text{REV}_i^*(Y_i^*, P_i^*, n_i^*, z_i) - \text{Cost}_i^*(Y_i^*, w_i^*, r_i^*, u_i) = 0 \text{-----} (7)$$

Based on the equation (5.5) and (5.6), we can define the H-Statistic as the sum of elasticities of revenue with respect to input prices. H-Statistic can be calculated mathematically as follows.

$$H = \sum_{i=1}^n \frac{\partial \text{Rev}}{\partial w} * \frac{w}{\text{Rev}} \quad \text{And} \quad H = \sum_{i=1}^n \frac{\partial \text{Rev}}{\partial r} * \frac{r}{\text{Rev}}$$

The estimated value of PH-Statistic will tell us about the structure of the market. The detailed description is as follows.

Perfect Competition Test

In perfect competition, the market operates under conditions where firms earn normal profits, and there exists a one-to-one correlation between costs and revenue. This implies that a one percent increase in revenue is precisely matched by a one percent increase in costs, ensuring market equilibrium. Therefore, in testing for perfect competition, we formulate the following testable hypothesis:

Under this hypothesis, if the calculated value of the H-Statistic equals one, it provides evidence in support of perfect competition, confirming that firms in the market are earning normal profits and operating at equilibrium. Conversely, if the calculated value deviates significantly from unity, it suggests deviations from perfect competition, indicating potential inefficiencies or market distortions requiring further investigation.

H_0 : PH = 1 perfect competition across firms in a given industry

H_1 : PH \neq 1 There is no competition

There are some important assumptions which are crucial for the validity of the above mentioned hypothesis. The first one is each and every firm under consideration may follow the behavior of profit maximization. Secondly, the revenue and cost function should be normal functions. The last is that every firm operates in the long run and is in equilibrium. The following model will be used for calculations of Panzar-Rosse H Statistic to gauge the market structure of the industrial sector of Pakistan.

$$\text{REV}_{it} = \alpha_0 + \alpha_1 \text{CL}_{it} + \alpha_2 \text{CK}_{it} + \alpha_3 \text{RM}_{it} + \alpha_4 \text{OC}_{it} + \phi Z_{it} + \epsilon_{it} \text{-----} (8)$$

The natural log of input prices will give us elasticities. The H-Statistic will then be represented as.

$$H = \sum_{i=1}^n \alpha_i$$

The H statistic is calculated as the sum of elasticities of input prices which is represented from the coefficients.

Data and Description of Variables

In the initial segment, our focus will be on discussing and providing a brief overview of the variables involved in the Panzar-Rosse H Statistic indicator for assessing competition. Before delving into the specifics of these variables, it's important to identify the industries that will be analyzed within Pakistan's industrial sector. These industries are categorized broadly and primarily consist of firms listed on the Pakistan Stock Exchange. Data for these firms, spanning from 2007 to 2020, has been compiled by the State Bank of Pakistan (SBP)⁴ and is accessible through the "Financial Statements Analysis of Non-Financial Firms in Pakistan" section on the SBP website. To ensure the reliability of our analysis, the data will undergo thorough cleaning to identify and address any potential outliers, with a focus on utilizing three-year averages. While we have identified various industries for analysis, our selection will be based on data availability and relevance. Additionally, it's important to note that obtaining actual revenue and input costs from audited accounts can be challenging. Therefore, we will utilize the closest possible proxies available in the financial statements of firms for all variables of interest. The detailed description of these variables will be provided in the subsequent section.

Table 2: Data description and definition of variables for Panzar-Rosse H-statistic approach

Variables	Symbol	Definition
Revenue	REV	Revenue is quantified by summing up the total sales generated by firms, encompassing both domestic and international transactions with customers. This metric becomes relevant after deducting all associated expenses incurred during the sales process.
Assets Turnover	ATR	The Total Asset Turnover Ratio assesses how efficiently a company utilizes its assets to generate sales revenue. A higher ratio indicates better asset utilization for revenue generation, while a lower ratio suggests inefficiency. This metric serves as an alternative to revenues, providing robustness and stability to the analysis of the H-statistic in response to changes in the dependent variable.
Input Costs		Definition
Cost of Labor	CL	These costs encompass all salaries, wages, and additional benefits disbursed to labor employed by the firm in the production or finalization of goods.
Operating Fixed Assets (Proxy for Cost of Capital)	CK	This variable serves as a proxy for the "Cost of Capital." It encompasses assets utilized directly or indirectly in the production process, typically fixed in nature and not readily liquidated during regular operations. Examples include plants, machinery, vehicles, furniture, and fixtures utilized in production activities.
Raw Materials	RM	This comprises the overall expenditure associated with the acquisition of raw materials utilized in the production process, specifically for the creation of finished goods.

⁴ https://www.sbp.org.pk/departments/stats/annual_data.htm

Overhead Costs	OC	This comprises the overall expenditure associated with the acquisition of raw materials utilized in the production process, specifically for the creation of finished goods.
Firm Specific Variables	Symbol	Definition
Intangible Assets	IA	Intangible assets refer to non-physical or non-tangible assets that accrue value over time and through effort. They can vary between firms and encompass items such as copyrights, trademarks, patents, goodwill, and expertise in IT-related domains. These assets enhance the competitive advantage of firms relative to others.
Loans from Financial institutions (Liabilities)	Credit	Long-term liabilities encompass credits or loans that have a repayment period extending beyond one year. They often include loans from banks, non-bank financial institutions, and foreign loans, which may be secured or unsecured. These obligations, when prolonged, can potentially diminish the competitiveness of firms in the market.
Current Ratio	CR	The current ratio assesses a company's financial stability by comparing its current assets to its current liabilities. A higher ratio indicates better ability to meet short-term obligations, while a lower ratio suggests potential difficulties in fulfilling financial commitments. Calculated as current assets divided by current liabilities.
Return on Assets	RA	This measure serves as an alternative proxy for profits, indicating a company's profitability relative to its total assets. It also reflects the efficiency of firm management and the optimal allocation of assets. Calculated as the ratio of profits to total assets, it can also signal industry competition. "RA" will be utilized as an alternative to profits as an explanatory to ensure robustness in the analysis.

Results and Discussions

This section will present the results of our estimation based on the model specified in the methodology section. Initially, we will conduct a descriptive analysis of our data to gain insight into its structure. Following this, we will provide estimations of the H-statistic using pooled OLS, Fixed Effect, and Random Effect models, and then proceed to dynamic panel estimation using GMM (Gurka et al., 2012). Additionally, we will perform tests to assess equilibrium in the industrial sector. Finally, we will present the estimation of the Boone J indicator to examine the intensity of competition in the industry, alongside robustness checks (Griffith et al., 2005).

Descriptive Analysis

Before estimating the actual model, it is imperative to examine the descriptive statistics of our variables. This allows us to understand the behavior and structure of our dataset, facilitating appropriate model estimation. Upon reviewing the descriptive statistics table, it becomes evident that there is significant variation in the log of revenue among firms. This indicates the presence of both small and large firms in the dataset, reflecting heterogeneity and variation. Additionally, costs such as labor, capital, raw materials, and overhead costs exhibit relatively normal and similar ranges of variation. However, variables like current and quick ratios demonstrate substantial variations, suggesting the presence of both very small and large firms in the dataset.

Table 3: Descriptive statistics

Variable	Obs	Mean	Std. Dev.	Min	Max
REV	1947	14.136	1.878	4.997	18.057
CL	1477	11.392	2.329	2.314	16.156
CK	2241	13.302	1.998	3.332	17.486
RM	1224	14.052	1.84	1.792	17.704
OC	1311	13.001	1.691	3.401	17.169
CR	2304	2.532	27.005	0	875.037
RA	2301	45.767	2025.5	-7621.429	95274.359
Credit	2165	10.061	3.073	-1.309	15.431
IA	2304	16.656	290.529	0	12835.512

Descriptive analysis of financial ratios provides information about the financial condition and performance of the firms within the industrial sector. This information is relevant in the context of industrial competitiveness, which is one of the aims of the study. For example, considering indicators such as inventory turnover ratio, interest coverage ratio, debt to asset ratio, and return on assets provides important information with regard to the operational processes within the firms and their financial decisions.

The dataset provides insights into various financial and operational aspects of a sample of companies. Firstly, considering revenue (lnREV), companies exhibit an average revenue of approximately \$14.136 million, ranging from \$5 million to \$18 million. Labor costs (lnCL) and capital costs (lnCK) show average values of approximately \$11.392 million and \$13.302 million, respectively, with labor costs spanning from \$2.314 million to \$16.156 million and capital costs ranging from \$3.332 million to \$17.486 million. Raw material costs (lnRM) average around \$14.052 million, with a range between \$1.792 million and \$17.704 million. Overhead costs (lnOC) have an average of about \$13.001 million, varying between \$3.401 million and \$17.169 million. Moving to financial metrics, the current ratio (CR) demonstrates an average of 2.532, with considerable variability (standard deviation of 27.005) and a wide range of values (from 0 to 875.037). Return on assets (RA) displays an average of 45.767, although its standard deviation is notably high at 2025.5, suggesting significant variability. Credit availability (Credit) is approximately 10.061 on average, ranging from -1.309 to 15.431. Intangible assets (IA) show an average of 16.656, with a notable standard deviation of 290.529, and values varying from 0 to 12835.512. These variables provide a comprehensive overview of the financial and operational landscape of the sampled companies, serving as essential metrics for further analysis and decision-making processes.

This influences the competitiveness of the firms within the sector because of their future capacities to handle the market situation or invest in their projects (Oral, 1986). Differences in ROA will also be observed, and they will mostly depend on the technologies employed by the firm, the managerial approach to work, and the size of the firm (Safiuddin et al., 2015). These financial differences mean that, within the industrial sector, some companies are operating and competing better due to their large scale or good management. The companies that cannot earn as much as the latter, however, have good perspectives of growing when they manage to implement an effective strategy. Such differences in firms' performance and future potential in the context of the industrial competitiveness demonstrate the importance of using the robust methodology of statistical analysis, such as PH statistics, to assess and improve industrial competitiveness for ensuring long-term economic growth (Kay, 2014; Sirikrai & Tang, 2006).

Table 4: Matrix of correlations

Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
lnREV	1.000											
lnCL	0.912	1.000										
lnCK	0.744	0.758	1.000									
lnRM	0.934	0.856	0.739	1.000								
lnOC	0.922	0.891	0.805	0.840	1.000							
CR	0.174	0.142	0.021	0.085	0.103	1.000						
RA	0.079	0.062	-0.039	0.016	0.021	0.845	1.000					
Credit	0.390	0.304	0.300	0.307	0.283	0.308	0.275	1.000				
IA	0.753	0.717	0.687	0.701	0.772	0.040	-0.054	0.148	1.000			
ATR	-0.170	-0.149	-0.110	-0.180	-0.122	-0.059	-0.051	-0.093	-0.048	1.000		
ICR	0.060	0.021	-0.059	0.022	-0.002	0.076	0.116	0.096	-0.104	-0.000	1.000	
DAR	-0.375	-0.301	-0.215	-0.312	-0.290	-0.431	-0.319	-0.361	-0.193	0.050	-0.100	1.000

The variables are correlated at varying degrees, ranging from low 0.04 to high 0.89. Besides, the high correlation among the variables can add inefficiency and bias to the results, as evidenced by the larger multiplied by the greatest possible standard errors. A Random Effect Model can only partially eliminate the problems associated with correlation. For this reason, we will use Generalized Least Squares (Arellano & Bond, 1991; Moral-Benito et al., 2019). Moreover, we will use the generalized method of moments to decrease problems associated with correlation and multicollinearity. These two techniques will ensure the robustness of estimations.

When we estimate using the Panzar-Rosse approach, we strongly assume that the market is in long-run equilibrium (Panzar & Rosse, 1987). The implication of this assumption is extremely relevant, given the scope of our study. Our model relies on an analysis that uses data from 2007 to 2020, investigating almost 200 industrial sector firms listed on the Pakistan Stock Exchange. Additionally, the data for our sample of firms could exclude a relatively new firm without information. From the microeconomic perspective, this model implies that no firms enter or exit the industry since all firms in the sector only earn normal or zero economic profits. Moreover, any firm trying to earn abnormal profit and enter the industry when making such profits would be eliminated by other firms in the industry.

The model used in the analysis has four main input costs, which can be considered as labor costs, capital costs, the cost of raw material, and overhead costs. Other control variables associated with costs are also present in the model but should have been included to make the model more unwieldy. The pooled ordinary least square regression is then used to determine the estimates for the model employed, which allows for the arguments about the mechanics of the industrial sector competition in Pakistan (Oral, 1986; Sirikrai & Tang, 2006). The results and estimates of the employed model are presented in the following table. The information can be utilized to provide the implications of the factors related to the competition faced by the industry in Pakistan. This information, backed by an accurate analysis of the estimates, can provide a clearer picture of the functioning of industries.

Results for PR-H Statistic

This section is dedicated to the estimation of our model. We employ different econometric techniques, each used because it can tackle a problem. In our case, the problematic features of the dataset include a high level of variable correlation, a high level of firms' heterogeneity, and the

potential endogeneity of our independent variables (Deaton, 1985). Specifically, we use the Pooled Ordinary Least Squares as the starting point because the latter is the most frequently used regression analysis technique (Dielman, 1983). Further, it is necessary to mention that Pooled OLS cannot resolve our problems, meaning that we should compare the results obtained with the pooled OLS to those obtained with other methods (Moral-Benito et al., 2019). Notably, the improvements are connected with eliminating the biases due to the time-invariant or time-varying unobserved heterogeneity. Thus, I use Fixed Effects and Random Effects models. The former captures the effects of unobserved factors that do not change over time, whereas the latter can account for varying effects of unobserved variables.

To have more reliable and efficient results, I choose the Generalized Method of Moments to resolve the potential endogeneity issue. The GMM method controls the endogeneity of the independent variables, using lagged endogenous variables to avoid bias (Arellano & Bond, 1991). Therefore, I can use lagged variables of the dependent variable as the instruments, which allows for capturing the changing relationships between variables through time. Overall, using these various econometric techniques should help obtain reliable estimates of the model's parameters.

Table 5: Estimation of H-Statistic for industrial sector

Revenue	OLS	Fixed Effect	Random Effect	GMM
Input Variables				
lnCL	.224*** (.027)	.271*** (.029)	.224*** (.027)	.299*** (.043)
lnCK	-.152*** (.024)	-.056* (.033)	-.152*** (.024)	-.187*** (.033)
lnRM	.362*** (.018)	.274*** (.02)	.362*** (.018)	.454*** (.04)
lnOC	.533*** (.032)	.613*** (.042)	.533*** (.032)	.439*** (.044)
Firm Specific Variables				
CR	.068* (.036)	.041 (.043)	.068* (.036)	.033** (.045)
QR	-.083 (.077)	-.076 (.092)	-.083 (.077)	-.003 (.077)
RA	.012*** (.002)	.007*** (.002)	.012*** (.002)	.008*** (.001)
Credit	.061*** (.014)	.084*** (.019)	.061*** (.014)	.082*** (.02)
IA	.012*** (.003)	.013 (.004)	.032*** (.005)	.036*** (.001)
DAR	-.145*** (.052)	-.534*** (.099)	-.145*** (.052)	-.362*** (.115)
L.lnREV				.049 (.039)
_cons	1.221*** (.287)	-.515 (.613)	1.221*** (.287)	-.093 (.472)
Observations	530	530	530	525
Pseudo R ²	.z	.z	.z	.z
<i>Standard errors are in parentheses</i>				
*** $p < .01$, ** $p < .05$, * $p < .1$				

Therefore, we are using the Generalized Method of Moment to estimate the dynamic panel data estimator of (Blundell & Bond, 1998). This will give us robust results. GLS is used in the specification of random effect to tackle the issue of heterogeneity in the data (Arellano & Bond, 1991; Blundell & Bond, 1998).

Our analysis of the estimation models' results reveals that all techniques used show a high level of explanatory power with regard to the variability's in firm revenue. In addition, the parameters' stability across different econometric methods allows asserting their generalizability, while the alignment of input and control variable coefficients with their expected theoretical signs is also indicative of the results' validity. As for firm revenue, it is described by the positive and significant impact of labor, raw material, and overhead costs, indicating that firms' incorporation of these expenses is transferred to the consumers, who pay higher prices. Meanwhile, since the growth in the costs of capital cannot be transferred to the customer in a straightforward manner while varying among the firms, its negative association with firm revenue is notable (Chandra & Ro, 2008; Katayama et al., 2009). In other words, larger firms can have more in operating fixed assets, generating higher input costs to decrease their output and revenue.

As far as control variables are concerned, they also show the expected signs and significance levels. Specifically, higher ROA means that the assets are fully utilized and optimized and thus result in an increase in the revenue (Phusavat et al., 2011). On the other hand, higher IA levels imply a faster turnover of sales and an improvement of the financial stability, respectively, leading to increased revenue. With regard to the CR, the positive impact is observed as the firms with more assets relative to their liabilities tend to develop richer revenue (Gunawan et al., 2022). At the same time, the challenge of liquidating the assets is proven to have a negative CR, while the financial expenses also increase the revenue, showing the efficiency of the tolling of the financial resources. As for the market structure, the value of 0.9674529 is indicative of the monopolistic competition. In the meantime, the formal testing results show that the industrial sector is not a monopoly as the null hypothesis of $H=0$ is presented at the 1% level of significance. In other words, the market is characterized by differentiated products and, although no high barriers are in place, the presence of relatively easy entry is indicative (Alhadeff, 2022).

Table 6: Panzar-Rosse H-statistic in different techniques

Revenue	H-Statistic	F-Stat (H-Stat=0)	F-Stat (H-Stat=1)
Pooled OLS	.9674529	1465.03***	1.66
Fixed Effect	1.1012668	617.25***	5.22**
Random Effect	.9674529	1465.03***	1.66
GMM	1.0142251	404.92***	0.08

The results obtained in analyzing the market structure using the H-Statistic are different across econometric techniques. The pooled OLS, random effect, and GMM estimated models accept the null hypothesis of $H=1$, which suggests that the firms are operating in a perfectly competitive sector. In contrast, the fixed effect model rejects the hypotheses of monopoly and perfect competition, implying monopolistic competition among firms. This means that using the H-Statistic is sensitive and should be conducted cautiously, always opting for the most suitable econometric model. Given the choice between the results, the conclusion of the type of competition from the GMM estimated model is always preferred (Mubeen et al., 2020). The results are expected to operate better when the econometric assumptions are met. Therefore, this indicates that the competition from the industrial sector is perfectly competitive in Pakistan (Ul Haque, 2014). This

claim is justifiable by the fact that the sector has a large number of firms whose entry and exit are not subject to much of a restriction.

However, it is interesting how we can interpret an H-statistic of more than one. The H-Statistic value of 1.0795 suggests that a 1% increase in the cost of inputs will result in more than a 1% increase in revenue. This suggests that an increase in inputs results in more output by these firms, which indicates monopolistic competition rather than perfect competition among firms in Pakistan's industrial sector (Prestowitz Jr, 1994). Such results can be validated in the literature, but for this study, there was not much information on using Panzar-Rosse statistics in the industrial sector (Bikker et al., 2012; Mirza et al., 2016). Some studies were conducted in the banking industry, but this is a non-financial, non-bank-specific industry.

In conclusion, the overall results suggest that Pakistan's industrial sector operates under competition conditions. The results also show that there are some monopolistic competition dynamics, as shown by the fixed effect model (Fagerberg, 1996; Falciola et al., 2020; Felipe, 2007; Kay, 2014; Krugman, 1994; Makowski, 1982; Oral, 1986; Qazi et al., 2017; Sirikrai & Tang, 2006; Voulgaris & Lemonakis, 2014).

This understanding aligns with economic theories recognizing the possibility of firms exerting market power despite competition. The absence of conclusive evidence regarding the precise nature of competition underscores the complexity of assessing market dynamics. While the fixed effect model hints at monopolistic tendencies, it is crucial to acknowledge that other factors, such as regulatory frameworks, industry structure, and technological advancements, may influence competition levels.

The neoclassical rationale behind these results lies in recognizing market imperfections and traditional economic models' limitations in capturing real-world markets' intricacies. Neoclassical economics acknowledges that perfect competition, characterized by numerous small firms producing homogeneous products, is often an idealized benchmark rather than a reflection of actual market conditions.

In reality, markets are subject to imperfections such as barriers to entry, product differentiation, and asymmetric information, which can distort competition and lead to outcomes that deviate from the idealized competitive equilibrium. The presence of monopolistic competition dynamics in Pakistan's industrial sector reflects these imperfections, highlighting the need for a nuanced understanding of market dynamics beyond traditional economic models.

Furthermore, the study's recognition of limitations underscores the importance of continued research addressing these shortcomings. Future studies could adopt more robust methodological approaches, consider additional variables, or employ alternative econometric models to comprehensively understand competition dynamics in Pakistan's industrial sector. By doing so, researchers can contribute to refining economic theories and informing policymakers' efforts to promote competition and enhance market efficiency.

Conclusion and Policy Recommendations

In conclusion, the study is a valuable contribution toward understanding the competitive environment existing within the given country. The Panzar-Rosse PR-H Statistic is used to evaluate the Pakistan industrial sector framework and is targeted at a sample of 200 publicly traded companies acquired from the Pakistan stock exchange between 2007 and 2020. Using the Generalized Method of Moments allowed for addressing the of endogeneity (Arellano & Bond, 1991; Blundell & Bond, 1998). The results show that the competitive regime in the selected company's industrial sector is quite strong.

The calculations showed that the PR-H Statistic could be described as competing instead of monopolistic, supporting a strong competitive environment within the target industrial sector. The current study indicates that great opportunities exist for further promotion of competitiveness within the selected context, hence boosting the industrial sector's innovative and long-term opportunities. Developing policies suitable for further promoting competition in the selected area and lowering the existing entrance barriers and market transparency should be considered an important direction for industrialization.

Policy Recommendations

- Policymakers should focus on enhancing such regulation measures as Law provisions to guarantee fair competition between the industrial sectors by enhancing anti-competitive activities. Such measures may also include the reinforcement of the role of governmental agencies and the development of their capacity, further consolidating regulatory presumptions and transparency accountability measures.
- To enhance industrial sectorial competitiveness, one may introduce measures focused on adopting innovation and technology in the industrial sector and informatization. Such measures may also include various incentives to support the use of technology, such as R&D incentives, technology acquisition, and the role of creating conditions of cooperation between the industry and science.
- Small and medium enterprises, core performers in industrial competitiveness, need additional support to facilitate their growth and development. This measure may also include increased credit, training, and capacity-building and incorporating enterprise small or medium enterprises into the market.
- Good institutions and a smooth government flow are distinctly important to ensure fair and competitive industrial sector development. To achieve their goals, policy and fighting against corruption should be based on enhanced institution capacity-building, which is part of improving transparency and accountability.

Emphasizing the above recommendations, the national industrial sectorial competitiveness of Pakistan will promote sustainable industrial activities, economic growth, employment generation, and sustainable development.

References

- Alhadeff, D. A. (2022). *Monopoly and competition in banking*. Univ of California Press.
- Arellano, M., & Bond, S. (1991). Some tests of specification for panel data: Monte Carlo evidence and an application to employment equations. *The review of economic studies*, 58(2), 277-297.
- Baumol, W. J. (1982). Contestable markets: an uprising in the theory of industry structure. *American economic review*, 72(1), 1-15.
- Bikker, J. A., Shaffer, S., & Spierdijk, L. (2012). Assessing competition with the Panzar-Rosse model: The role of scale, costs, and equilibrium. *Review of Economics and Statistics*, 94(4), 1025-1044.
- Blundell, R., & Bond, S. (1998). Initial conditions and moment restrictions in dynamic panel data models. *Journal of econometrics*, 87(1), 115-143.
- Bresnahan, T. F. (1982). The oligopoly solution concept is identified. *Economics letters*, 10(1-2), 87-92.

- Bresnahan, T. F. (1989). *Empirical studies of industries with market power*. Handbook of industrial organization, 2, 1011-1057.
- Browne, S. (2012). *United Nations Industrial Development Organization: industrial solutions for a sustainable future*: Routledge.
- Causa, O., & Cohen, D. (2006). *Industrial Productivity in 51 Countries, Rich and Poor*. C.E.P.R. Discussion Papers, CEPR Discussion Papers.
- Chandra, U., & Ro, B. T. (2008). The role of revenue in firm valuation. *Accounting Horizons*, 22(2), 199-222.
- Considine, M., Marginson, S., Sheehan, P., & Kunnick, M. (2001). *The comparative performance of Australia as a knowledge nation*. Report to the Chifley Research Centre.
- Deaton, A. (1985). Panel data from time series of cross-sections. *Journal of econometrics*, 30(1-2), 109-126.
- Dielman, T. E. (1983). Pooled cross-sectional and time series data: A survey of current statistical methodology. *The American Statistician*, 37(2), 111-122.
- Dunning, J. H., & Narula, R. (2005). *Multinationals and industrial competitiveness: A new agenda*: Edward Elgar Publishing.
- Ezeala-Harrison, F. (1999). *Theory and policy of international competitiveness*: Bloomsbury Publishing USA.
- Fagerberg, J. (1996). *Technology and International Trade*. Chapter *Competitiveness, scale and R & D*: Norwegian Institute of International Affairs, (pp.38-54). Publisher: Edward Elgar, Cheltenham
- Falciola, J., Jansen, M., & Rollo, V. (2020). Defining firm competitiveness: A multidimensional framework. *World Development*, 129, 104857.
- Felipe, J. (2007). A note on competitiveness and structural transformation in Pakistan.
- Griffith, R., Boone, J., & Harrison, R. (2005). Measuring competition. *Advanced Institute of Management Research Paper*(022).
- Gunawan, R., Widiyanti, M., Malinda, S., & Adam, M. (2022). The effect of current ratio, total asset turnover, debt to asset ratio, and debt to equity ratio on return on assets in plantation sub-sector companies listed on the Indonesia stock exchange. *International Journal of Economic, Business, Accounting, Agriculture Management and Sharia Administration (IJEBAAS)*, 2(1), 19-28.
- Gurka, M. J., Kelley, G. A., & Edwards, L. J. (2012). Fixed and random effects models. *Wiley Interdisciplinary Reviews: Computational Statistics*, 4(2), 181-190.
- Katayama, H., Lu, S., & Tybout, J. R. (2009). Firm-level productivity studies: illusions and a solution. *International Journal of Industrial Organization*, 27(3), 403-413.
- Kay, N. (2014). *Competitive strategy*. Edinburgh: Edinburgh Business School, Heriot-Watt University.
- Kennedy, P. L., & Harrison, R. (1999). *Competitiveness in the World Sugar Industry: A Comparison of the EU and US Sugar Sectors*. *American Journal of Agricultural Economics*, 81(5).
- Kim, W. S., & Lyn, E. O. (1986). Excess market value, the multinational corporation, and Tobin's q-ratio. *Journal of International Business Studies*, 17, 119-125.
- Kleynhans, E. P. (2016). Factors determining industrial competitiveness and the role of spillovers. *Journal of Applied Business Research (JABR)*, 32(2), 527-540.
- Krugman, P. (1994). The myth of Asia's miracle. *Foreign affairs*, 62-78.

- Lall, S. (2003). *Reinventing industrial strategy: The role of government policy in building industrial competitiveness*. United nation conference on trade and development, G-24 discussion paper series.
- Makowski, L. (1982). Perfect competition, the profit criterion, and the organization of economic activity. In *Noncooperative Approaches to the Theory of Perfect Competition* (pp. 105-125): Elsevier.
- Márkus, G., & Zs, P. (2007). *Measuring micro-level competitiveness in the South Transdanubian Region of Hungary*. Paper presented at the 2nd Central European Conference in Regional Science (CERS), Nový Smokovec, Szlovákia.
- Mirza, F. M., Bergland, O., & Khatoun, I. (2016). Measuring the degree of competition in Pakistan's banking industry: an empirical analysis. *Applied Economics*, 48(53), 5138-5151.
- Moon, H.-C., & Cho, D.-S. (2000). National competitiveness: a nine factor approach and its empirical application. *Journal of International Business and Economy*, 1(1), 17-38.
- Moon, H. C., Rugman, A. M., & Verbeke, A. (1998). A generalized double diamond approach to the global competitiveness of Korea and Singapore. *International business review*, 7(2), 135-150.
- Moral-Benito, E., Allison, P., & Williams, R. (2019). Dynamic panel data modelling using maximum likelihood: an alternative to Arellano-Bond. *Applied Economics*, 51(20), 2221-2232.
- Morris, J., Hassard, J., & Sheehan, J. (2002). Privatization, Chinese-style: economic reform and the state-owned enterprises. *Public Administration*, 80(2), 359-373.
- Mubeen, R., Han, D., Abbas, J., & Hussain, I. (2020). The effects of market competition, capital structure, and CEO duality on firm performance: a mediation analysis by incorporating the GMM model technique. *Sustainability*, 12(8), 3480.
- Oral, M. (1986). An industrial competitiveness model. *IIE transactions*, 18(2), 148-157.
- Panzar, J. C., & Rosse, J. N. (1987). Testing for "monopoly" equilibrium. *The journal of industrial economics*, 443-456.
- Phusavat, K., Comepa, N., Sitko-Lutek, A., & Ooi, K. B. (2011). Interrelationships between intellectual capital and performance: Empirical examination. *Industrial Management & Data Systems*, 111(6), 810-829.
- Porter, A. L., Roessner, J. D., Jin, X.-Y., & Newman, N. C. (2001). Changes in national technological competitiveness: 1990, 1993, 1996 and 1999. *Technology Analysis & Strategic Management*, 13(4), 477-496.
- Porter, M. E. (1990a). The competitive advantage of nations. *Harvard business review*, 73(91), 896.
- Porter, M. E. (1990b). New global strategies for competitive advantage. *Planning review*, 18(3), 4-14.
- Porter, M. E. (1999). Michael Porter on competition. *The Antitrust Bulletin*, 44(4), 841-880.
- Prestowitz Jr, C. V. (1994). The fight over competitiveness: a zero-sum debate. *Foreign Aff.*, 73, 186.
- Qazi, U., Jahanzaib, M., Ahmad, W., & Hussain, S. (2017). An institutional framework for the development of sustainable and competitive power market in Pakistan. *Renewable and Sustainable Energy Reviews*, 70, 83-95.
- Quinn, J. B. (1992). The intelligent enterprise a new paradigm. *Academy of Management Perspectives*, 6(4), 48-63.

- Ray, S. C., & Desli, E. (1997). Productivity growth, technical progress, and efficiency change in industrialized countries: comment. *The American economic review*, 87(5), 1033-1039.
- Roy, A., Kim, N., & Raju, J. S. (2006). Assessing new empirical industrial organization (NEIO) methods: The cases of five industries. *International Journal of Research in Marketing*, 23(4), 369-383.
- Safiuddin, M., Islam, M. M., & Anisuzzaman, M. (2015). Impact of financial structure on firm's performance: A study on financial and nonfinancial sector in Bangladesh. *European Journal of Business and Management*, 7(3), 30-38.
- Schaeck, K., & Čihák, M. (2008). How does competition affect efficiency and soundness in banking? New empirical evidence.
- Sercovich, F. C., Ahn, C.-Y., Frischtak, C., Mrak, M., Muegge, H., Peres, W., & Wangwe, S. M. (1999). *Competition and the World Economy*. Books. Edward Elgar Publishing, number 1874.
- Shaffer, S., & DiSalvo, J. (1994). Conduct in a banking duopoly. *Journal of Banking & Finance*, 18(6), 1063-1082.
- Sirikrai, S. B., & Tang, J. C. (2006). Industrial competitiveness analysis: Using the analytic hierarchy process. *The Journal of High Technology Management Research*, 17(1), 71-83.
- ul Haque, I. (2014). Toward a competitive Pakistan: The role of industrial policy. *The Lahore Journal of Economics*, 19, 61.
- *United Nations Industrial Development Organization (UNIDO)*, (2023). Progress by Innovation. <https://www.unido.org/>
- Voulgaris, F., & Lemonakis, C. (2014). Creating a business competitiveness index: an application to Greek manufacturing firms. *Journal of Transnational Management*, 19(3), 191-210.
- Wong, P. K. (2003). From using to creating technology: the evolution of Singapore's national innovation system and the changing role of public policy. In *Competitiveness, FDI and technological activity in East Asia*: Edward Elgar Publishing.
- Zhang, K. H. (2014). How does foreign direct investment affect industrial competitiveness? Evidence from China. *China economic review*, 30, 530-539.