Lahore Journal of Economics
Volume 29, Issue 2,
Winter 2024

Impact of Efficiency-Seeking FDI on Pakistan's Macroeconomy: A Sectoral CGE Analysis

Jazib Mumtaz
Economist
Policy Research and Advisory Council, PRAC
Karachi Chamber of Commerce and Industry
jazib@prac.org.pk

Sayed Irshad Hussain
Associate Professor
SZABIST, University Karachi
dr.syed.irshad@szabist.edu.pk

Citation: "Mumtaz, J., and Hussain, I. S., (2025). Impact of Efficiency-Seeking FDI on Pakistan's Macroeconomy: A Sectoral CGE Analysis". *Lahore Journal of Economics*, *29* (2), 57–89. https://doi.org/10.35536/lje.2024.v29.i2.a3

Abstract: *The study examines the impact of foreign direct investment (FDI) inflows on Pakistan's macroeconomic framework, emphasizing improved capital efficiency and technological advancements. Utilizing a Computable General Equilibrium (CGE) model within the GTAP framework, it evaluates the effects of technology-driven FDI on key sectors, including manufacturing, exports, and demand-oriented industries. Key findings indicate that priority sectors such as food and beverages, light manufacturing, and heavy manufacturing experience the highest GDP growth from FDI-induced technological upgrades. Sectors like light manufacturing, metals, textiles, and heavy manufacturing demonstrate significant export increases and reduced reliance on imports. Conversely, demand-oriented sectors such as communication and retail trade drive higher imports. Manufacturing and export-oriented sectors help reduce the trade deficit, while retail trade, communication, and financial services contribute to its increase. The study concludes that attracting FDI to manufacturing and export-driven sectors is crucial. However, foreign investors tend to focus on market-seeking sectors. To encourage efficiency-seeking FDI in productive sectors, the government should enhance the business environment, lower costs, deregulate, and ensure a level playing field.*

Keywords: Efficiency-seeking FDI, general equilibrium, market-seeking FDI, Pakistan.

JEL Classification: C32, E31, E43, Q31, Q43.

Paper type: Research paper

Received: 5th March 2025 Revised: 7th May 2025 Accepted: 7th May 2025

Declarations

Ethical Approval:
Not Applicable

Competing interests:
No interest of financial or personal nature can be found with respect to the study

Authors' contributions:
First author contributed in data analysis, results interpretation & conclusion
Second author contributed in theoretical framework, literature review and Introduction

Funding
Not Applicable

Availability of data and materials:
Global Trade Analysis Project data base 10 has been used which is available on the website GTAP

Impact of Efficiency-Seeking FDI on Pakistan's Macroeconomy: A Sectoral CGE Analysis

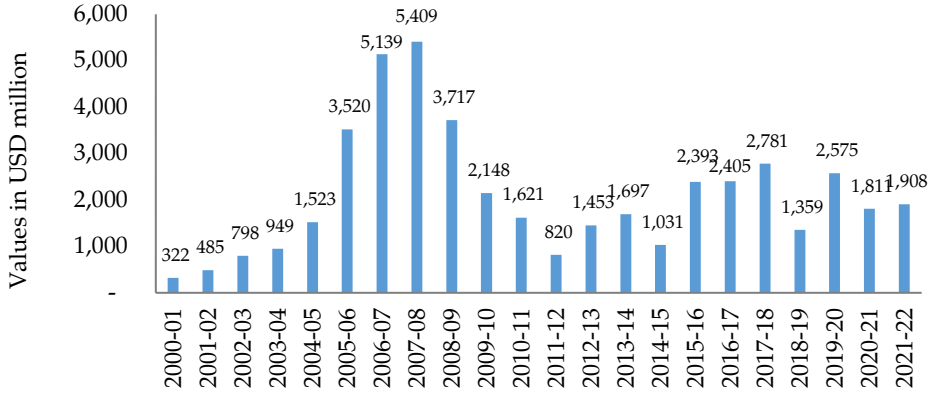
1. Introduction

Foreign Direct Investment (FDI) significantly enhances the welfare of the host country by providing various benefits, including innovations, new technologies, modern management techniques, skill development, increased capital inflows, job creation, improved working conditions for employees, and the growth of the industrial sector (Caves, R. E. (1974); Haddad, M., & Harrison, A. (1993); Perez T. (1997); and Markusen, J. R., & Venables, A. J. (1999). FDI plays a crucial role in fostering economic growth and development for both host and home countries. It facilitates economic integration and promotes regional cooperation across various parts of the world. FDI acts as a channel for technology transfer, contributes to the establishment of new businesses, and supports the development of human capital. Additionally, it strengthens domestic markets, enabling them to adapt to the demands of global business standards. However, the benefits of FDI depend on its quality and the underlying motivations of the investors. Dunning, J. H., & Lundan, S. M. (2008) identify four primary motives driving foreign investment in host countries: market-seeking, natural resource-seeking, strategic asset-seeking, and efficiency-seeking. Efficiency-seeking FDI is driven by the goal of establishing new sources of competitiveness for firms and is typically directed toward locations with lower production costs. Meanwhile, strategic asset-seeking FDI focuses on enhancing a company's global or regional strategy by integrating into foreign networks of created assets, such as technology, organizational capabilities, and markets (Faeth, I. 2009).

The market-seeking motive for foreign direct investment (FDI) arises from factors such as market size, growth potential, purchasing power, and access to regional markets. Conversely, natural resource-seeking FDI is driven by the availability of natural and human resources in the host country. Efficiency-seeking FDI aims to lower production costs to enhance competitiveness, often targeting markets that offer cost advantages in labor and technology. These investors typically develop long-term plans to invest and seek to serve both regional and global markets. The quality of FDI is crucial for the host country, as it determines the extent of its positive impact. High-quality FDI stimulates domestic investment, fosters competition, promotes innovation, facilitates

technology transfer, and supports the growth of complementary industries within the host country. In the 1990s, Pakistan introduced market reforms and liberalization policies to integrate with the global economy. According to Figure 1, the country's net FDI inflows have consistently remained low over the past few decades, averaging around USD 2 billion annually. The highest FDI inflow recorded was USD 5.4 billion in 2008, and the lowest was USD 322 million in 2000-01. Since 2008, FDI has experienced a sharp decline, particularly in the financial services and telecom sectors. However, it rebounded in 2013-14 due to the launch of the China-Pakistan Economic Corridor (CPEC) and investor-friendly policies in the power sector.

Figure 1: Inflow of Foreign Direct Investment (Values in USD millions): Pakistan



Source: State Bank of Pakistan.

According to Table 1, the United States, China, European nations, and East Asian countries are the primary contributors to Pakistan's total FDI. However, their percentage share fluctuates based on geopolitical dynamics and domestic policies. Pakistan has implemented a liberalized investment regime by privatizing and deregulating key sectors. Between 2003 and 2008, the United States, the UAE, and the UK emerged as the leading investors in terms of value. The investments made by these countries represented the highest amount Pakistan had received up to that point. During the same period, China was the ninth-largest contributor to Pakistan's total FDI. However, from 2015 to 2021, China became the top FDI contributor in Pakistan.

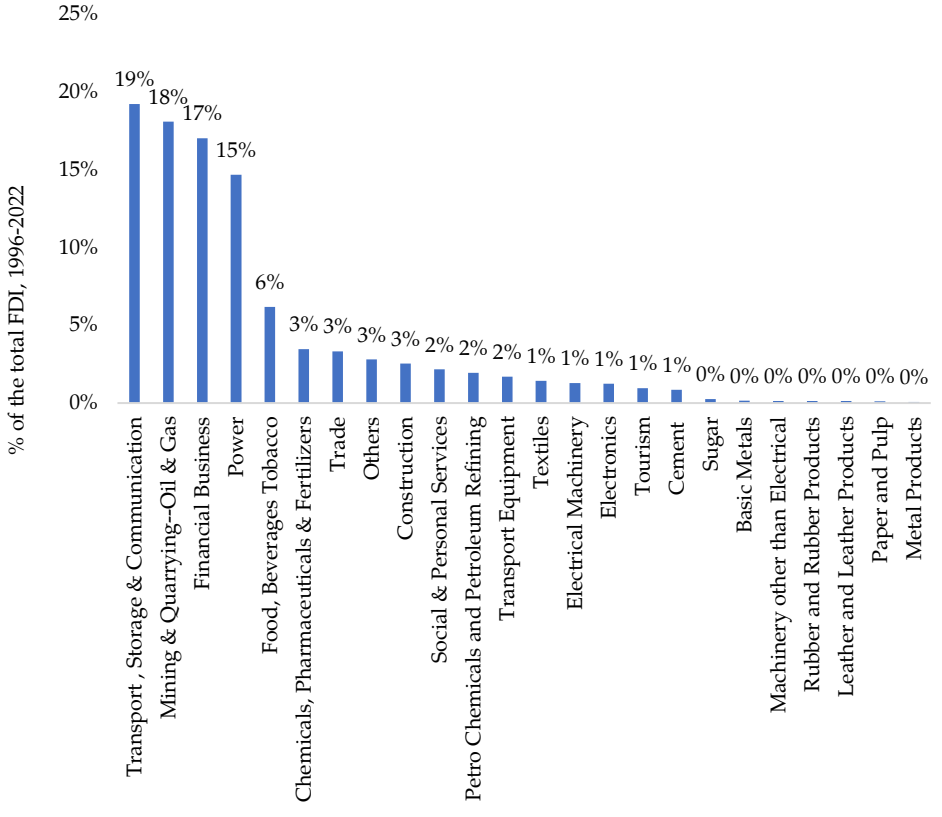
Table 1: FDI by Country and Time Peri

Rank	Country	2003-2008 USD million	% in total FDI (2009-2014)	Country	2009-2014 USD million	% in total FDI (2009-2014)	Country	2015-2021 USD million	% in total FDI (2015-2021)
	Afghan war (2003-2008)			**Pre-CPEC (2009-2014)**			**Post CPEC (2015-2021)**		
1	U.S.A.	4,174	23%	U.K.	1,667	21%	China	4,852	37%
2	U.A.E	3,355	19%	U.S.A.	1,597	20%	U.K.	1,117	9%
3	U.K.	2,074	11%	China	1,297	17%	Hong Kong	1,012	8%
4	Netherlands	1,107	6%	Hong Kong	823	11%	Netherlands	887	7%
5	Switzerland	1,085	6%	U.A.E	775	10%	Norway	685	5%
6	Mauritius	935	5%	Switzerland	763	10%	U.S.A.	577	4%
7	Malaysia	886	5%	Italy	613	8%	U.A.E	406	3%
8	Norway	832	5%	Austria	201	3%	Switzerland	386	3%
9	China	641	4%	Australia	200	3%	Italy	369	3%
10	Hong Kong	591	3%	Japan	191	2%	Malaysia	322	2%

Source: State Bank of Pakistan.

Pakistan's liberalization and deregulation policies in the energy, telecom, banking, and insurance sectors have created opportunities for private sector investment. Between 2000 and 2009, the country attracted significant foreign direct investment (FDI) in telecommunications, financial services, mining and quarrying, retail trade, and the food, beverage, and tobacco industries. During this period, the telecom sector received the highest FDI inflow, totaling USD 7.5 billion, followed by the financial services sector with USD 4.5 billion. The mining and quarrying sector secured USD 3.3 billion, while the retail trade and food and beverage sectors attracted USD 808 million and USD 892 million, respectively. Between 2014 and 2018, the power sector attracted the largest share of FDI (30%), followed by financial services (15%), mining (14%), and the food, beverage, and tobacco sector (10%). A sectoral analysis of FDI in Pakistan indicates that foreign investors have primarily targeted consumption-driven sectors with a large domestic market and high guaranteed returns. In contrast, export-oriented sectors have attracted minimal interest due to high business costs, inconsistent government policies, regulatory challenges, law and order issues, and unpredictable returns on investment.

Figure 2: FDI by Sector



Source: State Bank of Pakistan

Researchers are often motivated to analyze the impact of efficiency-seeking foreign direct investment (FDI) on Pakistan's economy due to its critical role in driving sustainable economic growth. Efficiency-seeking FDI, which targets countries offering cost advantages and productive efficiency to serve international markets, holds significant potential for developing economies like Pakistan. Given Pakistan's relatively low labor costs, strategic geographic location, and emerging infrastructure—especially through initiatives like the China-Pakistan Economic Corridor (CPEC)—the country presents an attractive destination for such investment. Scholars are therefore interested in investigating whether this type of FDI contributes to improved productivity, technology transfer, export expansion, and job creation. From a policy perspective, the government of Pakistan has introduced various reforms and incentives to attract foreign investment, including special economic zones and tax benefits. However, there remains a need for empirical evidence to assess

the effectiveness of these measures and to ensure that FDI is not only increasing in volume but also generating real efficiency gains within the economy. Furthermore, as Pakistan competes regionally with countries like Vietnam, Bangladesh, and India, it becomes essential to evaluate whether it is successfully leveraging its comparative advantages to attract high-quality investment. The limited empirical literature specifically focused on efficiency-seeking FDI in Pakistan also creates a research gap, encouraging scholars to employ econometric tools to explore its impact on key macroeconomic indicators. Ultimately, such research supports the broader development agenda, including the United Nations Sustainable Development Goals, by highlighting the role of FDI in enhancing industrial growth, innovation, and employment.

This study aims to examine the potential impact of efficiency-seeking foreign direct investment (FDI) inflows, particularly through enhanced capital efficiency, on Pakistan's macroeconomic framework. Given Pakistan's extended period of underinvestment and de-industrialization in recent decades, we identify key sectors that could benefit from capital infusion and technological advancements. FDI shocks have occurred in various sectors as a result of technological innovation. A Computable General Equilibrium model has been utilized to measure the impact of this innovation. Using the GTAP framework CGE model, we assume that capital efficiency is reflected in the technical changes in Pakistan's capital endowment. The Global Trade Analysis Project (GTAP) is a comprehensive research initiative that provides data and analytical tools for global economic analysis, particularly focused on international trade, climate, and development policies. It is based at Purdue University and is widely utilized by researchers, policymakers, and international organizations.

2. Review of Literature

The theoretical foundations of Foreign Direct Investment (FDI) have been thoroughly examined by early scholars. Kindleberger, C. P. (1969) pioneered the concept of multinational enterprises (MNEs), emphasizing monopolistic advantage theory. He proposed that foreign firms leverage ownership advantages, such as product differentiation, managerial expertise, and favorable host policies, to navigate entry barriers like risk, information asymmetry, and legal differences.

Building on these foundations, Buckley, P. J., & Casson, M. C. (2015) introduced the internalization theory, arguing that firms prefer to

internalize operations in the presence of market imperfections, such as high transaction costs and bargaining inefficiencies. Their framework emphasized industry, regional, national, and firm-specific determinants of FDI.

Caves, R. E. (1971) highlighted product differentiation as a critical motive for horizontal FDI, particularly in knowledge-intensive industries. Root, F. R., & Ahmed, A. A. (1978), through an empirical analysis of 41 developing countries, identified per capita GDP, trade ratios, and infrastructure as key determinants of FDI.

Subsequent studies expanded on macroeconomic dimensions. Milner, C., & Pentecost, E. (1996) found that market size, comparative advantage, and competitiveness significantly influenced U.S. FDI patterns in UK manufacturing. Campos, N. F., & Kinoshita, Y. (2003) and Garibaldi, P., Mora, N., Sahay, R., & Zettelmeyer, J. (2001), utilizing panel data analyses of transition economies, confirmed that FDI tends to be attracted to regions offering larger markets, low labor costs, resource abundance, and liberal trade regimes.

Regarding the growth effects of FDI, Hermes, N. and Lensink, R. (1999) and Bailliu, J.N. (2000) concluded that the positive impact of capital inflows depends on the development of the host country's financial sector. Similarly, de Mello Jr, L. R. (1999) and Zhang, K.H. (2001) emphasized that FDI-driven growth relies on the host economy's absorptive capacity and domestic investment climate.

Recent research revisits and refines these insights, particularly focusing on efficiency-seeking FDI and sectoral dynamics:

- Iamsiraroj and Ulubaşoğlu (2015) conducted a sector-specific global analysis and confirmed that efficiency-seeking FDI, particularly in manufacturing and tradable sectors, produces stronger positive spillovers on productivity and export expansion than market-seeking or natural resource-seeking FDI. Their results support a more targeted sectoral approach to FDI policy design.
- Maibetly, F., & Idris, I. (2022) investigate the underlying motivations behind Foreign Direct Investment (FDI) inflows into ASEAN lower-middle-income countries, along with China, Japan, and South Korea—collectively referred to as ASEAN+3. The study draws on the widely accepted classification of FDI motives into

market-seeking, resource-seeking, and efficiency-seeking categories, building on the foundational framework of Dunning's Eclectic Paradigm (OLI model). The literature emphasizes the role of infrastructure quality, trade openness, and human capital development as key determinants of efficiency-driven FDI. Countries with better logistics, skilled labor, and active participation in regional trade agreements (such as the ASEAN Free Trade Area and RCEP) are more likely to attract such investments.

- Jaiswal, K. K., & Kumar, N. (2025) investigate the multifaceted role of inward Foreign Direct Investment (FDI) in enhancing India's trade performance and promoting sustainable economic growth. Their study aligns with existing literature that underscores FDI's potential to serve as a catalyst for economic development, particularly in emerging economies. They find that FDI has positively influenced the export capabilities of Indian firms, especially in sectors like pharmaceuticals, where foreign investment has led to improved production capacities and enhanced access to international markets. This observation is consistent with prior studies indicating that FDI can improve export performance by providing capital, technology transfer, and managerial expertise.

Empirical studies focusing on Low Income countries provide direct relevance to the present analysis:

- Te Velde, D. W. (2024) observed that efficiency-seeking FDI often generates employment, particularly in labor-intensive sectors. Te Velde (2024) noted that export-oriented FDI in Cambodia and Honduras increased formal sector jobs, although there were wage disparities.
- Sun, Y., Taglioni, D., & Winkler, D. (2024) emphasize that efficiency-seeking FDI can drive structural upgrading in host economies through strong forward and backward linkages. Sectors well-integrated into GVCs (e.g., light manufacturing, textiles, chemicals) are better positioned to benefit from technology transfers and economies of scale.

Overall, the literature supports the hypothesis that attracting efficiency-seeking FDI to productive, export-oriented sectors—along with domestic efforts to strengthen absorptive capacities—is critical for achieving sustained economic growth and competitiveness in developing countries like Pakistan.

3. Methodology

The research tool used in this study is the Computable General Equilibrium (CGE) model because it can model the interrelations between industries and regions while simulating the impact of policy choices. Arrow, K. J. (2005) stated that "in all cases where the repercussions of proposed policies are widespread, there is no real alternative to CGE." Although the CGE is a relatively recent development, the literature on this subject is rich and growing. For instance, Babatunde, K. A., Begum, R. A., & Said, F. F. (2017), Wickramasinghe, K., & Naranpanawa, A. (2022), and others have surveyed the widespread application of these models in analyzing policy impacts.

General equilibrium theory is based on the Walrasian model of equilibrium. The Walrasian equilibrium occurs when demand and supply balance each other in an interconnected market of an economy. Arrow, K. J., & Debreu, G. (1954) developed an abstract general equilibrium structure to perform numerical functions using realistic economic data. Computable General Equilibrium Models are simulations that utilize those structures with varying prices, demand, and supply levels to achieve equilibrium across different sets of markets. CGE models are employed for empirical analysis and to assess the various impacts of economic shocks on welfare, household income, and economic growth. Uses of computable general equilibrium models can be found across diverse fields such as fiscal reforms, planning, and international trade (see studies such as Perry, M. (2008), Gunning, J. W., & Keyzer, M. A. (1995), Shields, M. L. (1998), and Francois, J. (1998), Martin, W., & Winters, L. A. (1996), and Harrison, G. W., Rutherford, T. F., & Tarr, D. G. (1997). Computable General Equilibrium models are based on the circular flow of commodities within an open economy. There are two main actors in this circular flow: households, who are the ultimate owners of the factors of production and also participate in the consumption of produced goods, and firms, which hire factors of production from households to produce goods that are subsequently consumed by those households. The equilibrium model also takes into account the government's role through taxes and expenditures on households in the form of subsidies and direct transfers. The circular flow

can be analyzed from the factor inputs to firms to produce goods supplied to households, which control the supply of factor services, and vice versa.

In the GTAP model, production generates income that accrues to factor endowments, which is then allocated to the regional household. This income is subsequently spent on three components of final demand: private consumption, government expenditure, and savings—the latter being channeled into investment. Each category of final demand, along with intermediate input purchases, includes both domestically produced and imported goods, thus contributing to firms' domestic and export sales.

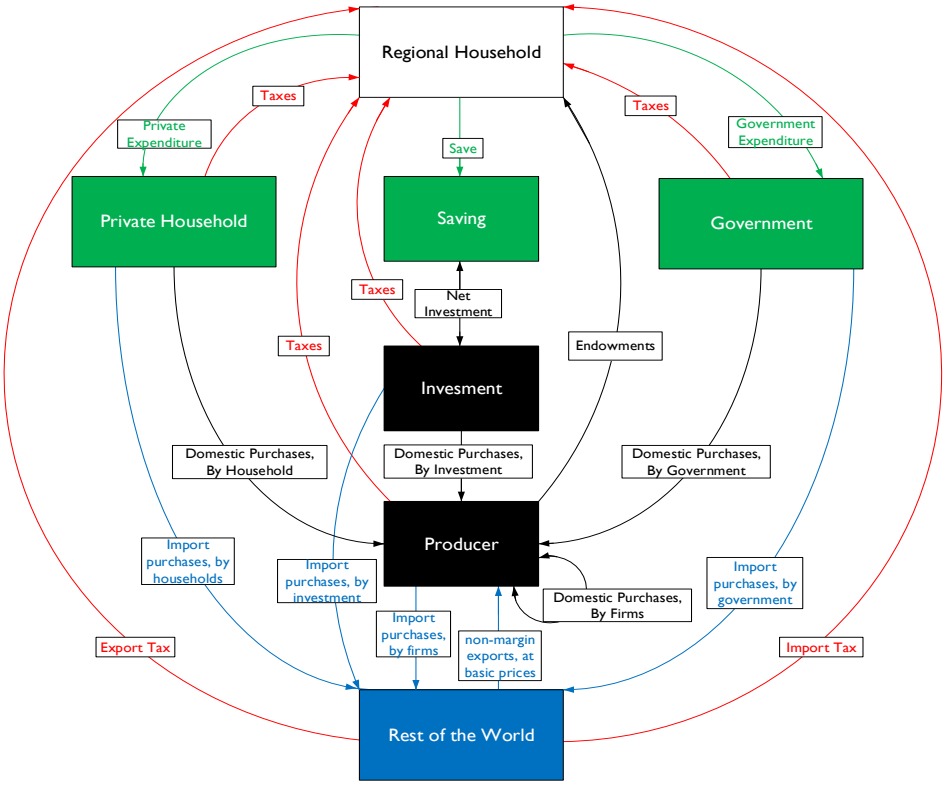
Accounting rules are based on the Walrasian general equilibrium. Production and consumption activities in the economy absorb the flow of goods and factors so that the output of firms is fully consumed by households, and firms employ primary factors from the household endowment. Therefore, the quantities produced of a given commodity must be demanded by other firms and households in the economy. This condition, once achieved, is known as market clearance. The value in the circular flow process is defined as the total sum of revenue from the production of goods that are distributed to households as income, to other industries as intermediate inputs, and to the government in the form of taxes. The value of output produced in the economy must equal the inputs purchased in the economy and the payments to the primary factors employed in the production process. The condition for equilibrium to occur is that producers make zero profits. Rather than explicitly imposing equilibrium in investment markets, the GTAP model applies Walras' Law and relies on the clearing of other markets, thereby implicitly ensuring investment equilibrium.

This condition resembles the accounting principle of balancing the budget and is known as income balance. The computable General Equilibrium Model estimates a set of prices based on three conditions: market clearance, zero profit, and income balance; these conditions thus define Walrasian general equilibrium.

The model assumes no international trade in primary factors and excludes re-exports, allowing only domestically produced goods to be exported. Inventory investment is not considered, and working capital is not treated as a factor of production. The external accounts are limited to merchandise trade and net capital inflows; they do not include foreign income receipts or payments, remittances, or international aid flows.

Figure 1 explains the difference between SAM 2007-08 and SAM 20015:

Figure 1: SAM 2007-08 vs SAM 2015



Source: Social Accounting Matrices SAM 2007-08 vs SAM 2015.

The 2007–08 and 2015 Social Accounting Matrices (SAMs) for Pakistan differ in structural composition and parameter values, reflecting changes in the economy and methodological approaches over time. Below is a comparative overview highlighting these differences:

4. Structural Differences

2007–08 SAM

- Production Sectors: 51
- Factors of Production: 27
- Household Groups: 18

- Labor Categories: 10 types, including distinctions by farm size and region
- Land Categories: 12 types, differentiated by farm size and irrigation status
- Capital: Disaggregated into livestock, formal, informal, and agricultural capital
- Methodology: Developed using a Bayesian information-theoretic approach to ensure consistency with national accounts

2015 SAM

Production Sectors: 85

- Factors of Production: 12
- **Household Groups**: 16, categorized by land ownership and income quartiles
- **Labor Categories**: 5 types, including small farmers, medium farmers, farm workers, non-farm skilled, and non-farm unskilled workers
- **Land Categories**: 3 types, based on farm size (small, medium, large)
- **Capital**: Classified into agricultural, formal, and informal capital
- **Methodology**: Constructed using updated data sources, including the Household Income and Expenditure Survey (HIES) 2015, to reflect more recent economic conditions

Parameter Value Differences

- Intermediate Input Coefficients:

a. 2007–08: Derived from the 1991 Input-Output matrix, adjusted using agricultural cost data and trade statistics

- *2015*: Updated using more recent data, including the HIES 2015 and other contemporary.

- Total Factor Productivity (TFP):

b. *2007–08*: Calibrated based on sectoral outputs and inputs, with some assumptions due to data limitations

c. *2015*: Re-estimated using updated economic indicators and data sources to reflect changes in productivity

- Scale and Share Parameters:

d. *2007–08*: Included detailed scale parameters for agricultural production functions and share parameters for manufacturing and services

e. *2015*: Adjusted to account for structural changes in the economy, with recalibrated parameters reflecting shifts in sectoral contributions

The transition from the 2007–08 to the 2015 SAM indicates a shift towards greater detail and updated representations of Pakistan's economic structure. The 2015 SAM's expanded sectoral coverage and refined household classifications allow for more nuanced policy analysis, particularly in assessing the impacts of economic shocks and policy changes on different segments of the population.

The GTAP 10 database is used for the analysis. The GTAP 10 Database is a comprehensive global economic dataset developed by the Global Trade Analysis Project (GTAP) at Purdue University. It serves as a foundational resource for computable general equilibrium (CGE) modeling and policy analysis. It covers four benchmark years, includes 141 countries and 65 sectors, and encompasses a wide range of activities. Input files containing the parameter values have been attached in other documents. The elasticity values of Pakistan in the GTAP model are mentioned in Table 1.

Table 1: Elasticity Values of Pakistan in GTAP Model

Sectors	Elasticity of Substitution Primary Factors	Elasticity of Substitution Imports	Elasticity of substitution domestic/imported	CDE substitution
OilP	0.386	6.66	3.06	0.757
Extraction	0.2	4.92	5.07	0.777
Food & Bev	1.12	6.15	2.86	0.816
Textile	1.26	7.5	3.75	0.81
Leather	1.26	8.1	4.05	0.81
ChemRub	1.26	6.6	3.3	0.773
LightMnfc	1.26	7.24	3.55	0.773

Sectors	Elasticity of Substitution Primary Factors	Elasticity of Substitution Imports	Elasticity of substitution domestic/imported	CDE substitution
Metals	1.26	6.57	3.25	0.773
HeavyMnfc	1.26	8.35	3.81	0.772
Electricity	1.26	5.6	2.8	0.741
FinBus	1.26	3.8	1.9	0.654
TransComm	1.66	3.8	1.9	0.722

Source: Author's calculation based on 2015 SAM.

The MyGTAP model is a specialized extension of the standard GTAP (Global Trade Analysis Project) model, designed to enhance its ability to analyze the distributional impacts of trade and policy changes at a more disaggregated level. The MyGTAP model is used when the goal is to go beyond aggregate economic outcomes and understand who wins and who loses from economic shocks or policies. It is particularly useful for countries like Pakistan, where inequality, poverty, and subnational disparities are key policy concerns. The objective of this study is to analyze the effect of FDI at the sectoral level; therefore, the standard GTAP model is better suited for this stage of the study.

Assumptions Regarding Sectoral Technological Improvements

In this study, it is assumed that improved capital efficiency is introduced individually in each sector while keeping all other sectors' technological parameters constant. This sector-specific simulation strategy serves several purposes. First, it allows for a clear isolation of the effects of capital-augmenting technological change within each sector, avoiding confounding general equilibrium effects that could arise from simultaneous sectoral shocks. Second, it maintains the ceteris paribus condition, a cornerstone of economic analysis, ensuring that observed changes in macroeconomic and sectoral outcomes are attributable solely to improvements in the targeted sector.

Economically, this assumption represents scenarios where efficiency-seeking FDI is selectively directed toward specific sectors—such as textiles, chemicals, or light manufacturing—without immediate parallel technological upgrades throughout the rest of the economy. It reflects real-world policy approaches where governments target industrial upgrading sector by sector, and acknowledges the gradual diffusion of technological advancements across the economy. Moreover, this approach aligns with standard practice in CGE modeling Harrison, G. W., Rutherford, T. F., &

Tarr, D. G. (1997); Wickramasinghe, K., & Naranpanawa, A. (2022), enabling clearer sectoral policy recommendations.

5. Empirical Analysis - A Computable General Equilibrium Model

This section aims to analyze the potential impact of Foreign Direct Investment (FDI) inflows, particularly through improved capital efficiency, on Pakistan's macroeconomic framework. Given Pakistan's extended period of underinvestment and de-industrialization, we identify key sectors that require capital infusion along with advanced technologies. A significant finding is that Pakistan's manufacturing sector shows weak forward linkages due to the limited adoption of sophisticated technologies in production processes. The priority sectors identified for capital and technological improvement include refined petroleum, textiles, chemicals and rubber, leather, heavy manufacturing, light manufacturing, extraction, and metals. Currently, the primary recipients of FDI in Pakistan are the power sector, financial services, food and beverages, transportation and communication, and mining. Using a Computable General Equilibrium (CGE) model, we assume that improved capital efficiency is represented by technological advancements in Pakistan's capital endowment. The CGE Framework for Pakistan is based on the Social Accounting Matrix (SAM) of 2015.

Research Simulation

To analyze the effect of improved capital efficiency, we have increased the technical change in both existing and new potential sectors by 50 percent. Given the limited access to advanced technology across all sectors of the economy, we have assumed a 50 percent improvement in capital efficiency in every sector to examine the sectoral differences in response to a similar increase in capital efficiency driven by FDI inflows. Assuming other factors remain constant, it is also assumed that each sector individually receives access to improved technology.

Base Line Model & Simulation Strategy

The baseline Computable General Equilibrium (CGE) model used in this study is built on the Global Trade Analysis Project (GTAP) 10 database, incorporating Pakistan's 2015 Social Accounting Matrix (SAM) as its core economic structure. The model is calibrated to replicate the benchmark equilibrium conditions of the Pakistani economy for the year 2015, ensuring that the initial values of key macroeconomic indicators—

including real GDP, sectoral outputs, trade flows, investment, and consumption—are fully consistent with the observed national accounts and GTAP data.

In the baseline configuration, no external shocks are applied, and all policy instruments (such as tariffs, output taxes, and government expenditures) remain unchanged. The model assumes perfect competition and constant returns to scale while incorporating the Armington assumption for product differentiation between domestic and imported goods. Additionally, factor markets (labor, capital, land, and natural resources) are assumed to clear, and investment–savings balances are maintained under Walrasian equilibrium.

To simulate the impact of Foreign Direct Investment (FDI)-induced technological upgrading, the simulation introduces an exogenous shock to the model by adjusting the capital-augmenting technical change variable (afe) within the GTAP framework. Specifically, the technical efficiency of capital is increased by 50% in the relevant sectors, while all other variables—including import tariffs (tms), export taxes (tm), output taxes (to), elasticities of substitution (esubva), population, government expenditure, and investment savings—are held constant. This approach isolates the effect of capital efficiency improvements attributable to FDI inflows, ensuring a clear assessment of sector-specific responses without interference from other policy or external shocks. Each sector is individually subjected to a 50% increase in capital efficiency, simulating the technological spillover effects of FDI aimed at manufacturing and export-oriented sectors. The results are compared against the baseline equilibrium to evaluate changes in real GDP, sectoral output, exports, imports, and domestic prices. Thus, the simulation strategy adopts a partial shock approach, wherein only one exogenous variable (capital-specific technical change) is adjusted, preserving the integrity of the baseline structure and allowing for clear attribution of macroeconomic and sectoral outcomes to the efficiency-seeking nature of FDI.

Rationale for the Magnitude of the Capital Efficiency Shock

The decision to simulate a 50% increase in capital-specific technical efficiency (afe) across selected sectors is based on both theoretical and empirical considerations. Efficiency-seeking FDI is well-documented to bring substantial improvements in productivity through the infusion of advanced technologies, superior managerial practices, and better capital goods. Empirical evidence from transition economies and developing

countries suggests that FDI-driven capital efficiency improvements typically range between 30% and 70% over the medium term (Borensztein, E., De Gregorio, J., & Lee, J. W. 1998; de Mello Jr, L. R. 1999);

Applying a uniform 50% shock across all sectors enables standardized comparisons of sectoral responses, isolating structural differences in linkages and competitiveness instead of variations in shock magnitude. Furthermore, the magnitude of the shock ensures model stability is preserved, avoiding non-linear distortions that can occur from excessively large exogenous changes in CGE simulations.

This approach is consistent with precedents in the CGE literature (e.g., Babatunde, K. A., Begum, R. A., & Said, F. F. 2017); (Wickramasinghe, K., & Naranpanawa, A. 2022), where technical change shocks of 30–60% have been used to simulate sectoral upgrading scenarios. Given Pakistan's current development goals, especially those related to Special Economic Zones and technology-driven FDI attraction policies, a 50% improvement in capital efficiency is considered a plausible and policy-relevant assumption.

Priority Sectors

Considering the scenario, the analysis below emphasizes the potential effects of enhancing capital efficiency in priority sectors on sectoral performance, measured by real GDP growth, trade orientation, and impacts on output and prices.

Textile

An increase in the capital efficiency of Pakistan's top exporting sector, namely textiles, will increase real GDP by 0.8 percent. Exports from the textile sector will rise by 33.3 percent, while imports will see a sharp decline of 11.6 percent (See Table 1). However, all sectors of the economy will witness an increase in imports, with an average growth of 5.87 percent. The output of the textile sector will grow by 22.8 percent, accompanied by a price reduction of 4.86 percent. The price level falls due to improved quality and competition among efficient producers. Related sectors such as grains and crops, meat and livestock, food & beverages, services such as electricity, utilities & construction, transportation and communication, and other services will experience increased output, demonstrating a positive spillover effect from the rise in textile sector output. Conversely, other sectors, including leather, chemicals and rubber, and light and heavy

manufacturing, will face reduced output and price increases as resources flow toward the textile sector due to technological upgrades. Furthermore, the an increase in output from the textile sector will compel the existing sector to compete for raw and intermediate goods from related sectors.

Table 2: Simulated Impact of a Percentage Increase in Capital Efficiency on Textile Sector Performance

SECTORS	REAL GDP	EXPORTS	IMPORTS	OUTPUT	PRICES
OilP		0	5.14	0.5	1.38
Textile	0.75	33.33	-11.68	22.83	-4.86
Metals		0	6.11	-4.84	2.59
leather		0	11.82	-0.03	3.01
ChemRub		0	7.06	-1.88	2.47
GrainsCrops		0	14.32	0.69	3.13
MeatLstk		0	9.73	0.23	3.24
Forestry		0	3.64	-1.7	2.45
Extraction		0	0.51	-2.29	0.98
Food & Beverages		0	6.37	0.23	2.9
LightMnfc		0	8.45	-1.54	2.78
HeavyMnfc		0	4.84	-1.64	1.9
FinBus		0	4.69	-0.91	3.09
Electricity		0	6.7	0.43	1.97
Util_Cons		0	9.4	1.98	2.27
TransComm		0	6.44	0.62	2.92
OthServices		0	6.21	0.09	2.79
Average		1.96	5.87		

Source: Author's calculation based on 2015 SAM.

While the simulation demonstrates significant gains in output and exports due to a 50% increase in capital efficiency in the textile sector, it is important to clarify that these results represent a counterfactual scenario rather than an assessment of historical FDI inflows. In 2015, the textile sector received only $43.9 million in FDI, which is inadequate to create such large-scale improvements in efficiency. However, the model assumes that capital efficiency improves across the entire sector, simulating the potential impact of substantial and widespread FDI-driven technological upgrading. Consequently, the findings underscore the potential benefits of increasing efficiency-seeking FDI in textiles rather than reflecting the effects of current investment levels.

Chemicals & Rubber

Improving technical efficiency in the chemical and rubber sectors by 50 percent will boost Pakistan's real GDP by 0.23 percent. The sector will see a 15 percent increase in exports alongside a 5 percent reduction in imports. On average, other sectors of the economy will experience a slight

0.89 percent increase in imports. Output will grow by 4 percent, accompanied by a 2.48 percent decrease in prices (See Table 2). All other sectors of the economy will experience positive growth in output and prices except for textiles and metals, underscoring the importance of the sector's strong forward linkages with other parts of the economy.

Table 3: Simulated Impact of a Percentage Increase in Capital Efficiency on Chemical and Rubber Sector Performance

SECTORS	REAL GDP	EXPORTS	IMPORTS	OUTPUT	PRICES
OilP		0	1.1	0.43	0.25
Textile		0	0.56	-0.95	0.2
Metals		0	1.6	-0.35	0.43
leather		0	1.9	0.15	0.45
ChemRub	0.23	15.13	-4.83	3.95	-2.48
GrainsCrops		0	0.25	0.05	0.16
MeatLstk		0	1.47	0.16	0.47
Forestry		0	2.1	0.34	0.62
Extraction		0	0.74	0.03	0.31
Food & Beverages		0	1.4	0.19	0.48
LightMnfc		0	1.55	0.13	0.41
HeavyMnfc		0	1.19	0.06	0.32
FinBus		0	1.05	-0.05	0.6
Electricity		0	1.42	0.42	0.37
Util_Cons		0	1.1	0.84	0.31
TransComm		0	1.42	0.35	0.55
OthServices		0	1.17	0.18	0.44
Average		0.89	0.89		

Source: Author's calculation based on 2015 SAM.

Refined Oil (Oil P)

Assuming that Pakistan's technological efficiency in refineries improves by 50 percent while keeping other factors constant, Pakistan's real GDP will rise by 0.41 percent. Refined oil exports are expected to grow by 7.8 percent. Other related sectors, including metals, chemicals, rubber, light manufacturing, heavy manufacturing, electricity generation, and construction, will also see an increase in exports. The import of refined oil will decrease by 3.65 percent, while, on average, all sectors of the economy will experience a reduction in imports by 0.2 percent. With enhanced technology, the output of refined oil tends to expand by 0.2 percent accompanied by a 1.4 percent reduction in prices (See Table 3). Technological upgrading in this sector will have a positive spillover effect on metals, chemicals, rubber, electricity generation, other utilities, and construction, as these sectors will experience increased output along with lower prices. All these sectors have strong forward linkages with refined oil, which is a fundamental input for

these related industries. Interestingly, all other sectors of the economy will also see an expansion in output. This underscores the fact that refined oil is the essential ingredient upon which Pakistan's industrial structure relies. The expansion in output will boost the demand for factors of production, which, in turn, increases their returns. Returns on natural resources and land rise more than those for skilled labor and capital.

Table 4: Simulated Impact of a Percentage Increase in Capital Efficiency on Refined Oil Sector Performance

SECTORS	REAL GDP	EXPORTS	IMPORTS	OUTPUT	PRICES
OilP	0.41	7.83	-3.65	0.2	-1.4
Textile		0	0.03	-0.01	0
Metals		0.39	-0.06	0.17	-0.06
leather		0	0.05	0.02	0.01
ChemRub		0.06	0	0.03	-0.01
GrainsCrops		0	0.03	0.01	0.01
MeatLstk		0	0.04	0.02	0.01
Forestry		0	0.07	0.03	0.02
Extraction		0	0.08	0.02	0.01
Food & Beverages		0	0.04	0.02	0.01
LightMnfc		0.02	0.02	0.03	0
HeavyMnfc		0.02	0.04	0.05	0
FinBus		0	0.04	0.03	0.01
Electricity		0.03	0.02	0.04	-0.01
Util_Cons		0.03	0.02	0.04	-0.01
TransComm		0	0.05	0.03	0.01
Oth.Services		0	0.03	0.02	0
Average		0.49	-0.19		

Source: Author's calculation based on 2015 SAM.

Leather

Leather is a significant export-oriented SME sector in Pakistan. Enhancing the sector's technical efficiency while maintaining other factors constant will boost real GDP by 0.03 percent. Exports are projected to grow positively by 2.2 percent, with imports decreasing by 0.93 percent. The output of the leather sector will rise by 0.16 percent, accompanied by a price reduction of 0.28 percent (See Table 4). The output of all other sectors will increase slightly, while prices in the related sectors are expected to remain unchanged. The results also suggest that the leather sector requires greater technical efficiency than its current level, as it relies on traditional production techniques.

Table 5: Simulated Impact of a Percentage Increase in Capital Efficiency on Leather Sector Performance

SECTORS	REAL GDP	EXPORTS	IMPORTS	OUTPUT	PRICES
OilP		0	0.02	0.03	0
Textile		0	0.03	0	0
Metals		0	0.02	0.02	0
leather	0.03	2.18	-0.93	0.16	-0.28
ChemRub		0	0.02	0.02	0
GrainsCrops		0	0.06	0.02	0.01
MeatLstk		0	0.15	0.09	0.03
Forestry		0	0.03	0.02	0.01
Extraction		0	0.02	0.01	0
Food & Beverages		0	0.03	0.04	0
LightMnfc		0	0.02	0.02	0
HeavyMnfc		0	0.02	0.02	0
FinBus		0	0.02	0.02	0
Electricity		0	0.02	0.03	0
Util_Cons		0	0.01	0.01	0
TransComm		0	0.03	0.03	0
OthServices		0	0.02	0.02	0
Average		0.13	-0.02		

Source: Author's calculation based on 2015 SAM.

Heavy Manufacturing

Providing better technology in Pakistan's heavy manufacturing sector while keeping other factors constant will boost real GDP by 0.86 percent. As the most capital-intensive sector, technological upgrades are expected to increase sectoral exports by 38 percent and reduce imports by 8.3 percent. On average, imports across all sectors will rise by 3.6 percent. The output of the heavy manufacturing sector will grow by 13.3 percent, accompanied by a price reduction of 6 percent (See Table 5). Related sectors such as refineries, mineral extraction, light manufacturing, financial services, electricity generation, transportation, communication, and other services will see an increase in output due to positive spillover effects and strong backward and forward linkages with heavy manufacturing.

Table 6: Simulated Impact of a Percentage Increase in Capital Efficiency on Heavy Manufacturing Sector Performance

SECTORS	REAL GDP	EXPORTS	IMPORTS	OUTPUT	PRICES
OilP		9.67	-2.71	1.93	-1.73
Textile		0	3.06	-5.59	1.2
Metals		0	4.59	-0.02	1.11
leather		0	6.25	0.53	1.45
ChemRub		0	2.92	-1.04	1.04
GrainsCrops		0	1.56	-0.41	1.2

MeatLstk		0	4.44	0.51	1.44
Forestry		0	3.45	0.24	1.74
Extraction		0	18.94	1.87	2.76
Food & Beverages		0	3.76	0.58	1.5
LightMnfc		0	5.69	0.33	1.48
HeavyMnfc	0.86	37.65	-8.26	13.35	-5.92
FinBus		0	5.54	1.22	1.83
Electricity		1.44	1.17	1.75	-0.26
Util_Cons		0	3.88	4.13	0.43
TransComm		0	3.78	0.94	1.32
OthServices		0	3.83	0.69	1.39
Average		2.87	3.64		

Source: Author's calculation based on 2015 SAM.

Light Manufacturing

Keeping other factors constant, increasing the technical efficiency of the light manufacturing sector by 50 percent will raise real GDP by 1.01 percent. Among the priority sectors considered in the analysis, this sector will experience the highest export increase at 67 percent, along with the most significant reduction in imports, specifically by 23 percent. On average, all sectors will experience an increase in exports by 4 percent. The sector's output will grow by 15 percent while prices will decrease by 11 percent (See Table 6). Refineries, leather, meat and livestock, food and beverages, heavy manufacturing, financial services, electricity generation, utilities, construction, transportation, and communication will all positively impact their output, demonstrating the upstream and downstream linkages. These results suggest that investment in the technical upgrading of light manufacturing will significantly enhance the sector's performance and have positive repercussions on the related sectors.

Table 7: Simulated Impact of a Percentage Increase in Capital Efficiency on Light Manufacturing Sector Performance

SECTORS	REAL GDP	EXPORTS	IMPORTS	OUTPUT	PRICES
OilP		0	3.89	1.61	0.75
Textile		0	3.14	-5.37	1.16
Metals		0	5.22	-1.11	1.5
leather		0	6.83	0.58	1.59
ChemRub		0	2.47	-0.28	0.8
GrainsCrops		0	1.91	-0.36	1.28
MeatLstk		0	5	0.58	1.6
Forestry		0	13.37	7.18	4.68
Extraction		0	3.2	-0.3	1.18
Food & Beverages		0	4.13	0.66	1.63
LightMnfc	1.01	67.74	-23.46	15.16	-11.04
HeavyMnfc		0	4.35	0.64	1.18
FinBus		0	4.9	1.11	1.99
Electricity		0	4.79	1.57	1.09
Util_Cons		0	4.68	3.81	1
TransComm		0	4.22	1.09	1.48
OthServices		0	3.59	0.92	1.15
Average		3.98	3.07		

Source: Author's calculation based on 2015 SAM

Metals

Increasing the basic metal sector's technical efficiency while keeping other factors constant will boost real GDP by 0.2 percent. Exports are projected to experience positive growth of 52.6 percent, accompanied by a 12 percent decrease in imports. The output of the metal sector is set to rise by 19 percent with a 7 percent reduction in price (See Table 7). The expansion in metal sector output will create positive pressure on related sectors, encouraging them to increase their output. These sectors include refineries, heavy manufacturing, food and beverages, utilities, construction, transportation, and communication.

Table 8: Simulated Impact of a Percentage Increase in Capital Efficiency on Metals Sector Performance

SECTORS	REAL GDP	EXPORTS	IMPORTS	OUTPUT	PRICES
OilP		0	1.86	1.55	0.32
Textile		0	1.19	-2.46	0.52
Metals	0.22	52.26	-11.95	19.02	-7.43
leather		0	2.44	0.1	0.6
ChemRub		0	0.91	-0.58	0.43
GrainsCrops		0	0.43	-0.24	0.45
MeatLstk		0	1.62	0.09	0.56
Forestry		0	1.01	-0.21	0.63
Extraction		0	1.39	0	0.55
Food & Beverages		0	1.47	0.12	0.64
LightMnfc		0	2.12	-0.16	0.64
HeavyMnfc		0	1.75	0.16	0.47
FinBus		0	1.42	0.28	0.77
Electricity		0	1.95	1.55	0.35
Util_Cons		1.51	0.11	1.55	-0.35
TransComm		0	1.59	0.22	0.66
OthServices		0	1.48	0.11	0.62
Average		3.16	0.63		

Source: Author's calculation based on 2015 SAM.

Extraction

An increase in the technical efficiency of capital in the extraction sector (coal, oil, gas, and minerals), while holding other factors constant, will enhance real GDP by 0.2 percent. Exports from the extraction sector will rise by 23 percent, accompanied by a 4.8 percent decrease in imports (See Table 8). Output is expected to grow by 5 percent, alongside a 2.6 percent drop in prices. The growth of the extraction industry will likely have a positive spillover effect on related sectors, such as refineries, light and heavy manufacturing, metals, forestry, and various service industries.

Table 9: Simulated Impact of a Percentage Increase in Capital Efficiency on Extraction Sector Performance

SECTORS	REAL GDP	EXPORTS	IMPORTS	OUTPUT	PRICES
OilP		0.03	0.41	0.33	-0.01
Textile		0	0.81	-1.44	0.31
Metals		0	0.71	0.04	0.15
leather		0	1.51	0.15	0.35
ChemRub		0	0.43	-0.15	0.15
GrainsCrops		0	0.42	-0.11	0.32
MeatLstk		0	1.15	0.13	0.38
Forestry		0	1.73	0.71	0.63
Extraction	0.2	23.09	-4.83	5.34	-2.6
Food & Beverages		0	0.88	0.16	0.34
LightMnfc		0	1.06	0.01	0.29
HeavyMnfc		0.81	0.15	0.66	-0.13
FinBus		0	0.74	-0.01	0.39
Electricity		0.15	0.36	0.33	-0.03
Util_Cons		0	0.58	0.57	0.12
TransComm		0	0.9	0.19	0.32
OthServices		0	1.09	0.31	0.34
Average		1.42	0.48		

Source: Author's calculation based on 2015 SAM.

Food and Beverages

Assuming all other factors remain constant, increasing the technical efficiency of the food and beverages sector by 50 percent is projected to raise real GDP by 5.7 percent. This sector will see a substantial growth in exports, specifically by 74 percent, alongside the largest decrease in imports, noted at 28 percent among all sectors analyzed. On average, all sectors will face a modest increase in imports of 0.37 percent. The output of the sector is expected to grow by 11 percent, while prices will decline by 18.6 percent (See Table 9). All other sectors of the economy will positively benefit in terms of their output, reflecting the robust upstream and downstream linkages of the food and beverages sector within Pakistan's economy. The highest output increases will occur in meat, livestock, grains, forestry, leather, chemicals, and rubber.

Table 10: Simulated Impact of a Percentage Increase in Capital Efficiency on Food & Beverage Sector Performance

SECTORS	REAL GDP	EXPORTS	IMPORTS	OUTPUT	PRICES
OilP		3.22	3.79	5.39	-0.57
Textile		1.95	5.12	3.6	-0.28
Metals		7.75	1.11	4.37	-1.1
leather		69.06	-25.61	8.97	-8.91
ChemRub		9.48	1.49	6.78	-1.55
GrainsCrops		0	10.48	4.15	2.22
MeatLstk		0	12.58	6.73	2.12
Forestry		0.13	5.38	4.77	-0.03
Extraction		0	5.19	1.76	0.8
Food & Beverages	5.7	74.57	-28.31	11.32	-18.6
LightMnfc		7.95	0.53	4.75	-1.29
HeavyMnfc		4.54	2.56	3.56	-0.71
FinBus		3.55	3.2	5.11	-0.94
Electricity		5.12	2.9	5.43	-0.91
Util_Cons		3.87	-0.96	0.86	-0.89
TransComm		5.26	3.69	6.36	-1.56
OthServices		3.32	3.08	3.77	-0.88
Average		11.75	0.37		

Source: Author's calculation based on 2015 SAM.

Existing Sectors

This analysis examines the sectors that have attracted the most FDI in Pakistan. The power, financial services, retail trade, and communication sectors have drawn the most FDI and have slightly upgraded their technology compared to others. We assume that capital efficiency in one sector has improved by 50 percent while keeping other factors constant.

Power

The power sector's increased capital efficiency positively impacts the economy's real GDP by 0.4 percent. The sector expands due to positive export growth of 49 percent alongside a reduction in imports by 22 percent. Overall, the economy experiences a decrease in imports by 0.9%. Output in the power sector will grow by 1.7%, with a decline in power sector prices by 8.8 percent (See Table 10). The significant reduction in prices and output growth exerts a positive influence on the output of all sectors of the economy, resulting in a major increase in heavy manufacturing, refineries, light manufacturing, and the chemical and rubber industries. The results also indicate that a positive spur in the power sector has a larger impact on all sectors of the economy. Output expansion in every sector will increase the demand for factors of production, thereby enhancing their returns.

Table 11: Simulated Impact of a Percentage Increase in Capital Efficiency on Power Sector Performance

SECTORS	REAL GDP	EXPORTS	IMPORTS	OUTPUT	PRICES
OilP		0.66	0.32	0.71	-0.12
Textile		0	0.42	-0.1	0.05
Metals		7.63	-1.33	3.1	-1.08
leather		0	0.75	0.32	0.11
ChemRub		1.43	-0.13	0.69	-0.23
GrainsCrops		0	0.51	0.17	0.14
MeatLstk		0	0.71	0.33	0.14
Forestry		0	0.93	0.48	0.23
Extraction		0	1.31	0.31	0.26
Food & Beverages		0	0.54	0.33	0.09
LightMnfc		0.86	0.13	0.61	-0.14
HeavyMnfc		0.7	0.45	0.76	-0.11
FinBus		0	0.61	0.48	0.07
Electricity	0.41	49.43	-22.64	1.72	-8.83
Util_Cons		0.63	0.12	0.62	-0.15
TransComm		0	0.66	0.46	0.07
OthServices		0.12	0.42	0.41	-0.03
Average		3.62	-0.95		

Source: Author's calculation based on 2015 SAM.

Financial Business

An increase in the technical efficiency of capital within the financial industry will boost real GDP by 3.5 percent. The sector's exports will see a rise of 55 percent, accompanied by a 14 percent decrease in imports. On average, the economy's imports will grow by 10.37 percent. The output of the financial sector is expected to expand by 11 percent, with a drop in prices of 14 percent (See Table 11). The growth of the financial sector will create a positive spillover effect on the output of industries reliant on banking, such as refineries, metals, leather, apparel, both light and heavy manufacturing, electricity generation, utilities, transportation, communication, and other services.

Table 12: Simulated Impact of a Percentage Increase in Capital Efficiency on Financial Business Sector Performance

SECTORS	REAL GDP	EXPORTS	IMPORTS	OUTPUT	PRICES
OilP		0	7.96	4.91	0.75
Textile		0	16.57	-11.66	3.18
Metals		1.35	6.49	6.91	-0.21
leather		0	22.09	2.01	5.1
ChemRub		0	6.35	-1.98	2.29
GrainsCrops		0	8.73	-0.9	4.55
MeatLstk		0	17.81	1.8	5.79
Forestry		0	16.09	1.77	7.11
Extraction		0	15.54	-0.71	3.82
Food & Beverages		0	12.49	2.31	4.79
LightMnfc		0	7.19	5.38	0.39
HeavyMnfc		1.06	5.76	7.43	-0.18
FinBus	3.53	55.65	-14.89	11.51	-14.68
Electricity		0	12.29	4.72	2.39
Util_Cons		0	11.62	9.56	2.02
TransComm		0	13.49	2.98	4.7
OthServices		0	10.64	3.9	2.93
Average		3.42	10.37		

Source: Author's calculation based on 2015 SAM.

Communication, Retail Trade & Transport

Assuming other factors remain constant, improving the technical efficiency of the transportation and communication sector by 50 percent will boost real GDP by 14.2 percent. This sector includes retail trade, communications, and transportation, all of which are consumer-driven. It will see an increase in exports of 64 percent alongside a 13.5 percent reduction in imports, although all sectors will experience a notable rise in average imports by 20.8 percent. The output of this sector is expected to grow by 17 percent, with prices decreasing by 19 percent (See Table 12). All other sectors of the economy will positively impact their output, illustrating the upstream and downstream linkages. Overall, returns to all factors of production in the economy will significantly increase.

Table 13: Simulated Impact of a Percentage Increase in Capital Efficiency on Retail Trade/Communication & Transport Sector Performance

SECTORS	REAL GDP	EXPORTS	IMPORTS	OUTPUT	PRICES
OilP		10.92	14	17.87	-1.99
Textile		0	14.89	-0.8	1.12
Metals		1.77	20.9	19.32	-0.3
leather		0	32.1	12.31	4.92
ChemRub		35.45	0.07	20.04	-5.84
GrainsCrops		0	26.41	5.7	8.09
MeatLstk		0	40.36	11.57	10.31
Forestry		0	41.15	13.29	13.75
Extraction		0	34.08	6.82	6.95
Food & Beverages		0	16.85	13.59	1.2
LightMnfc		0	21.34	18.19	0.49
HeavyMnfc		0	21.54	19.32	0.76
FinBus		0	19.49	12.92	3.28
Electricity		0	19.68	17.63	0.15
Util_Cons		0	21.34	24.69	0.28
TransComm	14.22	64.26	-13.45	17.38	-19.09
OthServices		0	23.39	15.45	2.42
Average		6.61	20.83		

Source: Author's calculation based on 2015 SAM.

Interpretation and Sectoral Anomalies

While the simulation results offer important insights into the potential sectoral benefits of capital-augmenting FDI, some outcomes—particularly in sectors such as textiles, chemicals, or mineral products—seem disproportionate when compared to actual historical FDI inflows or the current size of these sectors. These results arise from the modeling structure, which assumes that firms within a given sector uniformly benefit from a 50% improvement in capital efficiency. Additionally, general equilibrium feedback effects—including labor and capital reallocation, wage adjustments, and input substitution—further influence outcomes across non-targeted sectors, sometimes producing non-linear or counterintuitive results.

It is therefore important to interpret these results as theoretical upper-bound estimates of the impact of comprehensive sector-wide technological upgrading, rather than as direct outcomes of current FDI levels. This approach is common in CGE-based policy simulations and aims to highlight sectors with high responsiveness to productivity-enhancing investment. Future research may refine these findings by incorporating firm heterogeneity, investment-specific elasticities, or

dynamic adjustment processes to more closely approximate real-world transition paths.

6. Conclusion

Upgrading technology in priority sectors such as food and beverages and light manufacturing is expected to drive the highest positive growth in real GDP, followed by heavy manufacturing, textiles, refined petroleum, chemicals and rubber, and metals. Trade analysis reveals that exports across all sectors are likely to increase, with the largest growth anticipated in light manufacturing (67.7%), metals (52.6%), heavy manufacturing (37.7%), textiles (33.3%), and chemicals and rubber (15.1%). Concurrently, imports in these sectors are projected to decline significantly, with major decreases in light manufacturing (23%), metals (12%), textiles (12%), and heavy manufacturing (8%), largely due to their reliance on advanced foreign inputs. Technological upgrades are expected to reduce this dependency and lower imports. In existing sectors—such as power, financial services, retail trade, and transportation and communication—technological improvements contribute more to real GDP growth than in the manufacturing sector. However, these demand-oriented sectors lead to a more pronounced average increase in imports, particularly when technical changes occur in the communication and retail trade sectors. On average, manufacturing and export-oriented sectors (e.g., refined petroleum, textiles, chemicals and rubber, leather, heavy manufacturing, light manufacturing, metals, extraction, food, and beverages) drive imports by 1.64%. In contrast, sectors like power, financial services, communication, and retail trade result in an average increase in imports of 10.08%. CGE simulations further reveal that manufacturing and export-oriented sectors reduce the trade deficit by an average of 1.32%, while retail trade, communication, and financial services increase the deficit by 5.53%. This underscores the need for technological advancements across both existing and manufacturing/export-oriented sectors. Currently, FDI inflows to Pakistan are predominantly market-seeking rather than efficiency-seeking. A shift towards efficiency-driven FDI, focused on technological upgrades, can enhance sectoral productivity, reduce import dependency, and improve overall economic efficiency.

The results of this study align with earlier CGE-based analyses of Pakistan's economy, highlighting the positive macroeconomic and trade impacts of sector-specific efficiency improvements and capital-deepening investments. Dorosh, P., Niazi, M. K., & Nazli, H. (2004) demonstrated that productivity gains in the manufacturing and agro-processing sectors

significantly boost GDP and output, particularly through strong forward and backward linkages. Similarly, Debowicz, D., Dorosh, P., Haider, H., & Robinson, S. (2012), using the 2007/08 SAM, found that capital and productivity improvements in manufacturing and export-oriented sectors lead to increased exports, reduced import dependence, and improved factor utilization. Siddiqui, R., Siddiqui, R., Iqbal, Z., & Kazmi, A. A. (1999), employing Pakistan's 1989/90 SAM, also concluded that foreign investment and technological enhancements in industry contribute to substantial output gains and trade balance improvements. Complementary evidence from GTAP-based studies (Ahmed, V., & O'Donoghue, C. (2010) further supports the idea that efficiency-seeking FDI and technical changes can lead to sectoral competitiveness and structural transformation in economies like Pakistan.

The simulation assumes a 50% improvement in capital efficiency to reflect the potential impact of sector-specific, efficiency-seeking FDI. This improvement captures not only the infusion of more productive physical capital but also associated spillovers such as managerial upgrading, better resource allocation, and the adoption of modern technologies. While this magnitude is stylized, it aligns with empirical evidence from other emerging economies where sustained FDI inflows have significantly enhanced sectoral productivity over time (Borensztein, E., De Gregorio, J., & Lee, J. W. 1998); (Wang, Y. 2012) & Wong, S., & Kulmer, V. 2012). Nevertheless, it is important to acknowledge that Pakistan's actual FDI inflows remain relatively low, averaging under $2 billion annually in recent years—well below regional comparators such as Bangladesh, Vietnam, and Egypt. Therefore, while the simulation reflects long-run potential under ideal policy and absorption conditions, the current economic structure may not yet support such immediate efficiency gains. These findings should thus be interpreted as representing a plausible upper bound, conditional on successful implementation of investment-friendly reforms, human capital upgrading, and regulatory modernization to enable effective FDI absorption.

References

Ahmed, V., & O'Donoghue, C. (2010). External shocks in a small open economy: A CGE-Microsimulation analysis. The Lahore Journal of Economics, 15(1), 45-90.

Arrow, K. J. (1983). General equilibrium (Vol. 2). Harvard University Press.

Arrow, K. J. (2005). Personal reflections on applied general equilibrium models. Kehoe, TJ, Srinivasan, TN & Whalley, J.

Arrow, K. J., & Debreu, G. (1954). Existence of an equilibrium for a competitive economy. In The Foundations of Price Theory Vol 5 (pp. 289-316). Routledge.

Babatunde, K. A., Begum, R. A., & Said, F. F. (2017). Application of computable general equilibrium (CGE) to climate change mitigation policy: A systematic review. Renewable and Sustainable Energy Reviews, 78, 61-71.

Bailliu, J.N. (2000). "Private capital flows, financial development and economic growth in developing countries", Working Paper No. 2000/15, Bank of Canada, Ottawa, ON.

Borensztein, E., De Gregorio, J., & Lee, J. W. (1998). How does foreign direct investment affect economic growth?. Journal of international Economics, 45(1), 115-135.

Buckley, P. J., & Casson, M. C. (2015). The internalisation theory of the multinational enterprise: A review of the progress of a research agenda after 30 years. International business strategy, 85-107.

Buckley, P.J., and Casson, M. (1976). The Future of the Multinational Enterprise (1st ed.). London: Macmillan

Campos, N. F., & Kinoshita, Y. (2003). Why does FDI go where it goes? New evidence from the transition economies. International Monetary Fund.

Campos, Nauro F., and Kinoshita, Yuko. (2003). Why Does FDI Go Where it Goes? New Evidence from the Transition Economies, IMF Working Papers 03/228.

Caves, R. E. (1971). International corporations: The industrial economics of foreign investment. Economica, 38(149), 1-27.

Caves, R. E. (1974). Multinational Firms, Competition, and Productivity in Host-Country Markets. Economica, 41(162), 176-193

de Mello Jr, L. R. (1999). Foreign direct investment-led growth: evidence from time series and panel data. Oxford economic papers, 51(1), 133-151.

Debowicz, D., Dorosh, P., Haider, H., & Robinson, S. (2012). A 2007-08 social accounting matrix for Pakistan. Pakistan Strategy Support Program (PSSP) Working Paper, (001).

Dorosh, P., Niazi, M. K., & Nazli, H. (2004). A Social Accounting Matrix for Pakistan, 2001-02: Methodology and Results. A Background Research Paper for the Pakistan Rural Factor Markets Study, World Bank. South Asia Rural Development Unit of the World Bank, Washington DC.

Dunning, J. H., & Lundan, S. M. (2008). Multinational enterprises and the global economy. Edward Elgar Publishing.

Faeth, I. (2009). Determinants of foreign direct investment–a tale of nine theoretical models. Journal of Economic surveys, 23(1), 165-196.

Francois, J. (1998). Scale economies and imperfect competition in the GTAP model. GTAP technical papers, 16.

Garibaldi, P., Mora, N., Sahay, R., & Zettelmeyer, J. (2001). What moves capital to transition economies?. IMF staff papers, 48(Suppl 1), 109-145.

Gongwe, A. G., Cutler, H., Fan, C. M., Shields, M., & Davies, S. (2011). Using a computable general equilibrium model to explore economic impacts of agglomeration economies on wages in northern Colorado.

Gunning, J. W., & Keyzer, M. A. (1995). Applied general equilibrium models for policy analysis. Handbook of development economics, 3, 2025-2107.

Haddad, M., & Harrison, A. (1993). Are there positive spillovers from direct foreign investment?: Evidence from panel data for Morocco. Journal of development economics, 42(1), 51-74.

Haider, A., & Khan, A. (2023). Foreign direct investment and industrial competitiveness in Pakistan: An input–output approach. Journal of Asian Economics, 85, 101502. https://doi.org/10.1016/j.asieco.2023.101502

Harrison, G. W., Rutherford, T. F., & Tarr, D. G. (1997). Economic implications for Turkey of a Customs Union with the European Union. European Economic Review, 41(3-5), 861-870.

Hermes, N. and Lensink, R. (1999). Foreign Investment, Financial Development and Economic Growth, University of Groningen, Groningen.

Hermes, N. and Lensink, R. (2003). "Foreign direct investment, financial development and economic growth", The Journal of Development Studies, Vol. 40 No. 1, pp. 142-63.

Iamsiraroj, S., & Ulubaşoğlu, M. A. (2015). Foreign direct investment and economic growth: A real relationship or wishful thinking?. Economic modelling, 51, 200-213. https://doi.org/10.1016/j.econmod.2015.08.009

Jaiswal, K. K., & Kumar, N. (2025). How Does Inward FDI Lead to Trade Performance and Sustainable Growth In India?. Journal of Lifestyle and SDGs Review, 5(2), e03892-e03892.

Kindleberger, C. P. (1969). American Business Abroad: Six Lectures on Foreign Direct Investment. New Haven, CT: Yale University PressB

Kindleberger, C. P. (1969). Measuring equilibrium in the balance of payments. Journal of Political Economy, 77(6), 873-891.

Maibetly, F., & Idris, I. (2022). Analysis of Factors Affecting Foreign Direct Investment (FDI) in ASEAN (Lower Middle Income) Plus Three: Market Seeking, Resource Seeking or Efficiency Seeking?. In Eighth Padang International Conference On Economics Education, Economics, Business and Management, Accounting and Entrepreneurship (PICEEBA-8 2021) (pp. 441-450). Atlantis Press.

Markusen, J. R., & Venables, A. J. (1999). Foreign direct investment as a catalyst for industrial development. European economic review, 43(2), 335-356.

Martin, W. (2000). Modelling the impacts of trade agreements on the environment. OECD Proceedings–Assessing the Environmental Effects of Trade Liberalisation Agreement: Methodologies, 219-235.

Martin, W., & Winters, L. A. (1996). An Economic Assessment of the Uruguay Round Agreement on Agriculture.

Milner, C., & Pentecost, E. (1996). Locational advantage and US foreign direct investment in UK manufacturing. Applied Economics, 28(5), 605-615.

Perez T. (1997). Multinational enterprises and technological spillovers: an evolutionary model. Journal of Evolutionary Economics 7: 169–192

Perry, M. (2008). Food production vs. biomass export vs. land-use change: a CGE analysis for Argentina.

Root, F. R., & Ahmed, A. A. (1978). The influence of policy instruments on manufacturing direct foreign investment in developing countries. Journal of International Business Studies, 9(3), 81-94.

Shields, M. L. (1998). An integrated economic impact and simulation model for Wisconsin counties. The University of Wisconsin-Madison.

Siddiqui, R., Siddiqui, R., Iqbal, Z., & Kazmi, A. A. (1999). The Impact of tariff reforms on income distribution in Pakistan: A CGE-based Analysis [with Comments]. The Pakistan Development Review, 789-804.

State Bank of Pakistan: https://www.sbp.org.pk/ecodata/index2.asp

Sun, Y., Taglioni, D., & Winkler, D. (2024). Efficiency-seeking FDI and global value chains: Implications for structural transformation. World Bank Policy Research Working Paper No. 10542. https://doi.org/10.1596/1813-9450-10542

Te Velde, D.W. (2024). Supporting economic growth in low- and middle-income countries. ODI Report. London: ODI (https://odi.org/en/publications/supporting-economic-growth-in-low-and-middle-income-countries-identifying-low-cost-interventions)

Wang, Y. (2012). Openness and productivity: The role of imports, FDI and international telecommunications. Latin American Journal of Economics, 49(1), 125-145.

Wickramasinghe, K., & Naranpanawa, A. (2022). Systematic literature review on computable general equilibrium applications in tourism. Tourism Economics, 28(6), 1647-1668.

Winters, P., Murgai, R., Sadoulet, E., de Janvry, A., & Frisvold, G. (1998). Economic and welfare impacts of climate change on developing countries. Environmental and Resource Economics, 12, 1-24.

Wong, S., & Kulmer, V. (2012). Trade Integration with the European Union: Poverty Impacts in Ecuador. The Developing Economies, 50(3), 236-267.

Zhang, K.H. (2001). "How does foreign investment affect economic growth in China?", Economics of Transition, Vol. 9 No. 3, pp. 679-93.