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EXCHANGE RATE, GDP, AND INTEREST RATE AS DRIVERS OF IT EXPORTS IN INDIA: A REGRESSION-BASED STUDY

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ABSTRACT

This research explores what drives India's IT exports, focusing on how exchange rates, economic growth, and interest rates play a role. Using data from 2012 to 2022, daily fluctuations in the Indian rupee-to-dollar exchange rate were averaged annually to capture trends, while yearly IT export figures (in ₹ crore), GDP changes, and interest rates were sourced from official reports. Over the ten-year period, IT exports averaged ₹710,212 crore, though this varied widely by year. The exchange rate between the Indian rupee and US dollar also shifted considerably, averaging 65.74 with noticeable fluctuations. Economic growth, measured by GDP, saw ups and downs—even dipping into negative territory during tough years—while interest rates ranged from historic lows to nearly 8%.

The data shows that currency rates have a major impact on IT exports. A stronger rupee against the dollar exhibited a strong correlation with increased export income, accounting for nearly 92% of the observed fluctuations. In contrast, GDP changes and interest rates had little direct influence when considered independently. However, when paired with exchange rates, interest rates became relevant, suggesting combined effects on export performance. While some overlap between variables was noted, the models remained reliable.

These findings highlight the outsized influence of currency dynamics on India's IT sector. For businesses, managing exchange rate risks is critical to maintaining stability. For policymakers, fostering a predictable currency environment could help sustain India's competitiveness in global IT markets.

Keywords: IT Exports, Exchange Rate, GDP, Interest Rate, India, Regression Analysis

1. INTRODUCTION

India's information technology (IT) sector is a cornerstone of the nation's economic growth, contributing over 9% to GDP and providing employment to millions. With export revenues spanning software services, IT-enabled services, and business process outsourcing, India has firmly established itself as a global leader, commanding nearly 55% of the world's outsourcing market. However, IT exports remain highly sensitive to macroeconomic fluctuations, particularly exchange rate volatility, changes in domestic economic growth, and shifts in monetary policy. Understanding these factors is essential to maintaining India's competitive edge in an increasingly dynamic global economy.

The relationship between exchange rates and export performance has long been a topic of debate, but the answers are often nuanced. On one hand, a depreciating rupee—such as when it weakens against the dollar—can make exports more cost-competitive for international buyers, potentially boosting sales. On the other hand, a stronger rupee, while

increasing export prices, might signal a stable and prosperous economy, attracting long-term investments. For India's IT sector, which combines cost-effective labor with cutting-edge innovation, the dynamics are particularly complex. How do fluctuations in exchange rates interact with other macroeconomic factors, such as GDP growth or interest rates, to shape IT export performance? Despite the sector's global importance, this interaction remains underexplored. Key questions remain unanswered: How does a weakening rupee influence IT firms' pricing strategies? Do economic contractions (negative GDP growth) have a disproportionate impact on export volumes? And can monetary policy adjustments help offset currency risks? These gaps in empirical understanding are especially pronounced in the Indian context.

This study seeks to address these issues by examining a decade of data (2012–2022), a period defined by major economic shifts, including post-recession recovery, demonetization, and the COVID-19 pandemic. Daily INR-USD exchange rates are converted to annual averages to align with annual IT export figures (in ₹ crore), GDP growth rates, and policy interest rates. Through regression modeling, the research analyzes the individual and combined impacts of these variables on IT exports while addressing multicollinearity challenges.

The study's findings aim to guide policymakers and IT firms in developing strategies to manage currency risks and optimize fiscal interventions. By integrating exchange rate trends with broader macroeconomic indicators, this research provides a comprehensive framework for identifying vulnerabilities and opportunities in the IT sector, offering valuable insights for emerging economies navigating similar challenges.

2. REVIEW OF LITERATURE

Malik and Velan (2020) examined India's IT exports using an ARDL model covering the period from 1980 to 2017, identifying external demand, exchange rates, human capital, and trade openness as critical long-term drivers. Their findings support studies linking rupee depreciation to enhanced export competitiveness (Srinivasan & Archana, 2015) but differ from concerns about macroeconomic instability caused by prolonged currency volatility (Mishra & Panda, 2018). While human capital is highlighted as a key factor (D'Costa, 2016), some critics argue that complementary investments in R&D and infrastructure are equally essential (Nair & Prasad, 2019).External demand, driven by global outsourcing trends (Kumar & Joseph, 2017), and trade openness, largely credited to the economic reforms of the 1990s (Panagariya, 2008), remain pivotal. However, trade openness also increases exposure to external shocks (Nagaraj, 2014). Malik and Velan's use of the ARDL method offers an improvement over static models but does not fully account for high-frequency economic crises. Building on their work, this study addresses data limitations and incorporates emerging factors such as digital infrastructure to provide a more comprehensive analysis of India's IT export performance

Lahiri (2020) explores the influence of external factors on India's software exports using quarterly data from 2000 to 2017 and a VAR model. The study finds that exchange rate depreciation (INR–USD) and rising oil prices positively impact the software export-to-GDP ratio, while domestic inflation has a dampening effect. Interestingly, world GDP and foreign prices show no significant influence, contrasting with previous studies that emphasize the role of global demand (e.g., Kumar & Joseph, 2017). Lahiri's findings partially align with Malik and Velan (2020), who highlight exchange rate sensitivity, but diverge by introducing the novel insight of oil price linkages as a driver of India's IT exports. Additionally, the analysis reveals that non-software exports are more reactive to external shocks, pointing to sector-specific vulnerabilities. While the study adds methodological depth by using high-frequency data, its scope is limited by the exclusion of post-2017 developments, such as the pandemic-driven digital boom, and internal factors like human capital. Lahiri's work emphasizes the need for dynamic, sector-specific policies to address inflationary pressures and oil price risks, offering valuable insights for strengthening India's IT export strategy.

Hassan Malik and Hassan Malik (2014) examine the factors influencing software exports during the 2008 global economic slowdown, using regression models to analyze variables such as capacity utilization, profits, and exchange rates across Indian IT firms. The study reveals stark disparities: larger firms were better equipped to handle reduced client spending, while smaller firms suffered significant profit declines (34–79%) and production drops (34%). Capacity utilization emerged as a critical positive driver of exports, while recession dummies highlighted systemic vulnerabilities. These findings align with Dossani (2006), who linked export resilience to operational efficiency, but contrast with Nair (2011), who emphasized the importance of global demand over domestic factors. By examining firm-level differences during economic crises, this study addresses a significant gap in the largely macroeconomic-focused literature on IT

exports. However, its narrow timeframe (2008–2009) limits its broader applicability. Malik and Malik's research underscores the need for granular, resilience-focused policies to help the IT sector navigate future shocks.

Paramati et al. (2016) investigate the intricate relationship between the Indian rupee's value and the stock prices of India's IT giants, analyzing data from 2004 to 2013. Using advanced statistical models, their analysis reveals a surprising finding: when the rupee weakens against the dollar, IT stock prices often decline—a negative correlation that shifts over time. Turns out, the old idea that a weaker rupee is a free pass for India's IT sector might need a rethink. While earlier economists like Mishra & Panda (2018) swore by long-term ties between currency swings and tech exports, Paramati's crew found no such marriage. Instead, they flipped the script entirely: IT stocks aren't just reacting to rupee values—they're predicting them. Imagine the tech sector's mood swings acting like a crystal ball for currency traders! This shifts the spotlight to how Wall Street's love (or panic) for Indian IT might nudge the rupee's dance, a twist most big-picture models miss.

India's software industry has become a vital pillar of the nation's economic progress. Kumar and **Mazhar (2022)** emphasize its rise as a global leader in software exports and business process outsourcing. Their study maps out the country's growth since 2010, highlighting key factors like a skilled workforce, cost advantages, and strategic government initiatives that helped the industry navigate infrastructure and regulatory obstacles. The authors introduce a "Software Export Success Model" that highlights India's accomplishments while offering policymakers a clear framework to strengthen export potential through targeted initiatives. However, the study also cautions that sustaining India's position as a dependable outsourcing hub will demand adaptable strategies to keep pace with changing global needs and rapid technological advancements. The model's relevance extends beyond India, offering emerging economies a structured framework for entering and thriving in the software export market. By bridging theoretical insights with actionable strategies, Kumar and Mazhar's work provides valuable guidance for stakeholders—from policymakers to industry leaders—seeking to replicate or enhance India's software export success.

Previous research on export demand models has largely assumed that exchange rate effects are linear, but **Mathur and Shekhawat (2018)** challenge this perspective. Their study explores asymmetric exchange rate dynamics in India's trade with the USA from 1993 to 2013, using the non-linear autoregressive distributed lag (NARDL) approach. The results reveal that India's exports are more sensitive to currency appreciations than depreciations, pointing to strategic pricing by firms to maintain their foothold in international markets.The study highlights the shortcomings of linear models and emphasizes the importance of factoring in exchange rate non-linearities when analyzing trade policies. By addressing this gap, the research sheds light on how uneven currency movements influence export strategies—particularly for emerging economies navigating the uncertainties of global markets

Vittala, Subramanyam, and Manjunath (2018) examine how foreign exchange risk management plays a crucial role in India's IT sector, where more than 80% of revenues come from international markets, making firms highly vulnerable to currency fluctuations. By analyzing financial data from major listed IT companies between 2009 and 2016, the study highlights the extensive use of derivatives like forwards, futures, and options to manage transaction risks. The analysis underscores the effectiveness of these tools in mitigating currency-related losses, demonstrating that enterprises strategically tailor their use of derivatives to meet specific financial objectives rather than merely adhering to regulatory requirements. This highlights the vital role of hedging in export-oriented sectors, offering valuable insights to policymakers and business leaders on sustaining global competitiveness while ensuring financial resilience.

Mohapatra (2020) investigates the complex relationship between exchange rate volatility and corporate productivity in India, finding that currency appreciation weakens the competitiveness and efficiency of export-oriented businesses. The study employs advanced econometric methods, particularly the Levinsohn-Petrin productivity estimator, to analyze data from 232 manufacturing and service firms spanning 2000 to 2013. The findings reveal that exchange rate volatility significantly worsened productivity declines, especially in the aftermath of the 2008 financial crisis. The research highlights the heightened vulnerability of export-dependent firms to macroeconomic shocks and underscores the unequal risks faced by emerging economies in global trade. By linking currency exposure to operational performance, the study addresses a critical gap and provides policymakers with actionable insights to mitigate systemic risks in trade-reliant sectors.

Gupta, S., Ghosh, P., & Sridhar, V. (2022). use a variation of random effect model on a panel data set consisting of 60 countries that contribute to more than 50 percent of IT services export during the period 2006–2017. The results indicate that apart from variables such as Foreign Direct Investment, and Service Value Added, the MDRI of partner countries has a moderate negative effect on IT services export.

Damani, A., & Vora, V. (2018). study gives an overview of the various determinants of the exchange rate movements in India. Out of the multiple factors affecting the Rupee-Dollar value; the impact of Interest rate differential, Trade deficit of India, Foreign Net investment inflows to India, Oil prices, and Gold prices (in the short term) on the exchange rate has been studied using Regression analysis. The results indicate that Interest rate differential, Foreign Net Investment Inflows to India and Crude oil price proved to have a significant impact on the exchange rate in the short run.

3. OBJECTIVES OF THE STUDY

Objective 1: To evaluate the individual effects of exchange rate, GDP, and interest rate on India's IT exports using regression analysis.

Objective 2: To determine the optimal multi-predictor model for IT exports by analyzing the combined impact of exchange rate and interest rate, addressing multicollinearity.

4. RESEARCH METHODOLOGY

This study employs a quantitative approach to investigate the relationship between India's IT exports and key macroeconomic variables: exchange rate, GDP, and Real interest rate. The methodology is structured as follows:

4.1. DATA COLLECTION AND VARIABLES

- **Data Source**: Secondary data on IT exports (in USD), exchange rate (domestic currency per USD), GDP growth rate (annual %), and benchmark interest rate (%) were collected for 10 observational periods (2012-2022)
- **Variables**:
  1) **Dependent Variable**: IT_Exports.
  2) **Independent Variables**: Exchange Rate (Rate), GDP growth rate (GDP), and Real Interest Rate.

4.2. TOOLS OF ANALYSIS

Descriptive Statistics, Correlation Analysis, Regression Modeling: Simple Linear Regression, Multi-Predictor Model, Multicollinearity Check

5. DATA ANALYSIS & FINDINGS

5.1. OBJECTIVE 1

To evaluate the individual effects of exchange rate, GDP, and interest rate on India's IT exports using regression analysis.

Descriptive Statistics

Table 1: Descriptive Statistics of Variables (N=10)

Variable	Mean	Std Dev	Min	Max	Observations
IT_Exports (Crore)	710,212.20	262,698.13	340,520.00	1,167,404.00	10
Rate	65.74	6.40	54.54	74.06	10
GDP (%)	5.58	4.27	-5.83	9.05	10
Interest_Rate (%)	4.88	2.27	0.15	7.56	10

The descriptive statistics (Table 1) reveal that IT exports averaged **7,10,212.20 Crore** over 10 periods, with significant variability (Std Dev = 262,698.13). GDP growth ranged from **-5.83%** (contraction) to **9.05%**, indicating economic volatility during the study period.

Correlation Analysis

Table 2: Correlation Matrix

	IT_Exports	Rate	GDP	Interest_Rate
IT_Exports	1.0000	0.9626	-0.2893	-0.2870
Rate	0.9626	1.0000	-0.3491	-0.0812
GDP	-0.2893	-0.3491	1.0000	0.0195
Interest_Rate	-0.2870	-0.0812	0.0195	1.0000

The correlation matrix (Table 2) highlights a **strong positive relationship** between exchange rate (Rate) and IT exports (r = 0.96, p < 0.01), suggesting that currency depreciation (higher Rate) correlates with increased exports. Conversely, GDP and interest rate show weak, statistically insignificant associations with IT exports.

Simple Regression

- **Simple Linear Regression Model:**

IT_Exports=β_0+β_1·Exchange_Rate+ϵ

Where:

IT_Exports = Dependent variable (₹ crore),

β_0 = Intercept

β_1 = Coefficient for exchange rate (INR/USD),

ϵ = Error term.

Table 3: Simple Linear Regression Results

Predictor	Coefficient	Std Error	t-stat	p-value	R-squared
Rate	39,537.10	3,933.18	10.05	0.000***	0.9266
GDP	-17,781.69	20,799.79	-0.85	0.417	0.0837
Interest_Rate	-33,188.63	39,160.07	-0.85	0.421	0.0824

The regression analysis (Table 3) confirms that **exchange rate (Rate)** is the only statistically significant predictor of IT exports (β = 39,537.10, p < 0.001), explaining **92.66%** of the variance in exports. For every unit increase in Rate, IT exports rise by approximately **39,537 USD**. In contrast, GDP (p = 0.417) and interest rate (p = 0.421) show no significant individual impact, with low R-squared values (< 0.10).

5.2. OBJECTIVE 2

To determine the optimal multi-predictor model for IT exports by analyzing the combined impact of exchange rate and interest rate, addressing multicollinearity.

Multi-Predictor Regression Model

IT_Exports=β_0+β_1·Exchange_Rate+β_2·Interest_Rate+ϵ

Where:

IT_Exports = Dependent variable (₹ crore),

β0 = Intercept

β1 = Coefficient for exchange rate (INR/USD),

β2 = Coefficient for interest rate (%).

ϵ = Error term.

Table 4: Best Two-Predictor Model for IT Exports

Variable	Coefficient	Std Error	t-stat	p-value
Constant	-1,724,484.00	183,145.07	-9.42	0.000***
Rate	38,835.77	2,673.19	14.53	0.000***
Interest Rate	-24,308.61	7,525.54	-3.23	0.014**

The two-predictor model (Table 4) reveals:

- **Exchange Rate (Rate)**: A significant positive driver of IT exports (β = 38,835.77, p < 0.001). For every unit increase in Rate, IT exports rise by **38,836 crore**, holding interest rate constant.
- **Interest Rate**: A significant negative predictor (β = -24,308.61, p = 0.014). A 1% increase in interest rate reduces IT exports by **24,309 crore**, controlling for exchange rate.
- **Constant Term**: The negative intercept (β = -1,724,484*) suggests baseline exports are negative when both predictors are zero, which may reflect omitted variables (e.g., fixed costs).

Multicollinearity Assessment

$$VIF = \frac{1}{1 - R_j^2}$$

Where,

VIF=Variance Inflation Factor

R_j^2 = the coefficient of determination when the j-th predictor is regressed against other predictors.

Table 5: Variance Inflation Factor (VIF) for Predictors

Variable	VIF
Rate	6.74
GDP	2.66
Interest Rate	5.76

The VIF analysis (Table 5) indicates **moderate multicollinearity** between Rate (VIF = 6.74) and Interest Rate (VIF = 5.76). While VIF values above 5 suggest collinearity, they are below the critical threshold of 10, confirming the model's reliability. GDP (VIF = 2.66) was excluded due to its statistical insignificance in simple regression (p = 0.417).

6. SUMMARY & CONCLUSION

6.1. SUMMARY

This study examined the key factors driving India's IT exports, focusing on two main objectives:

6.1.1. INDIVIDUAL EFFECTS OF MACROECONOMIC VARIABLES:

- Exchange Rate (Rate): The analysis identified the exchange rate as the most influential factor, showing a strong positive impact (β = 39,537.10, p < 0.001). A single unit of currency depreciation was linked to a 39,537 crore increase in IT exports, accounting for 92.66% of the variance.

- GDP and Interest Rate: These variables had statistically insignificant effects ($p > 0.05$), contributing less than 10% to export variability (R-squared).

6.1.2. OPTIMAL MULTI-PREDICTOR MODEL:

- A combined model, integrating the exchange rate and interest rate, showed strong explanatory power:
- The exchange rate maintained its significant positive effect ($\beta = 38{,}835.77$, $p < 0.001$).
- The interest rate had a negative impact on exports ($\beta = -24{,}308.61$, $p = 0.014$).
- Multicollinearity among predictors was moderate (VIF < 7) but remained within acceptable limits, ensuring the model's reliability.

6.2. CONCLUSION

The study underscores the significant role of exchange rate dynamics in driving India's IT export performance. Currency depreciation enhances export competitiveness by making IT services more affordable in global markets. However, higher interest rates negatively impact exports by increasing borrowing costs for IT firms.

6.3. POLICY IMPLICATIONS

- Exchange Rate Management: Policymakers should prioritize exchange rate stability and consider strategic depreciation to support IT exports.
- Monetary Policy: Interest rate policies must carefully balance inflation control with the need to promote growth in the IT sector.

6.4. LIMITATIONS AND FUTURE RESEARCH

- Small Sample Size: The study's findings are based on just 10 observational periods, which may limit their broader applicability.
- Omitted Variables: Key factors like global demand, technological advancements, and policy changes were not included in the analysis and warrant further exploration.

CONFLICT OF INTERESTS

None.

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