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Simulating the Impact of FDI Shocks on Macroeconomic Stability Using Agent-Based Modeling

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Abstract— Foreign Direct Investment (FDI) is a key driver of macroeconomic stability, particularly in emerging economies. This study utilizes Agent-Based Modeling (ABM) to examine the dynamic effects of FDI shocks on key macroeconomic indicators, including GDP, exchange rate, inflation, trade openness, and employment. Three simulation scenarios are conducted: (1) a baseline scenario with stable FDI inflows, (2) a positive shock with a 5% increase in FDI, and (3) a negative shock with a 5% decrease in FDI. The findings reveal that positive FDI shocks stimulate GDP growth and employment, though they may also contribute to inflationary pressures. In contrast, negative FDI shocks lead to economic contraction, exchange rate depreciation, and declining employment opportunities. The results emphasize the need for effective policy measures to stabilize FDI inflows, minimize volatility, and sustain long-term economic growth. By leveraging simulation-based economic modeling, this study provides valuable insights for policymakers on mitigating the risks associated with FDI fluctuations and enhancing economic resilience.

Keywords: Agent-Based Modeling, Economic Shocks, Foreign Direct Investment, Macroeconomic Stability, Service Sector.

I. INTRODUCTION

Foreign Direct Investment (FDI) serves as a pivotal catalyst for economic development, particularly in emerging economies (Sadashiv, 2023). By injecting capital, technology, and managerial expertise, FDI enhances productivity and stimulates growth across various sectors (Osano & Koine, 2016). The service sector, encompassing industries such as finance, telecommunications, and tourism, has notably benefited from FDI inflows (Dev, 2022). For instance, in the United States, approximately 60% of all foreign investment is directed toward the service sector, bolstering its global competitiveness (Chaitoo, 2020). Similarly, developing nations like India have experienced substantial FDI in services, leading to significant economic transformations. Traditional economic models often rely on aggregate data, which may overlook the complexities of individual behaviors and interactions within an economy (Chakraborty & Nunnenkamp, 2008). Agent-Based Modeling (ABM) addresses this limitation by simulating the actions and interactions of autonomous agents, such as firms, households, and governments (Janssen, 2005). This bottom-up approach allows for a more nuanced analysis of economic phenomena, including the transmission and impact of FDI shocks (Silvestre, 2020). ABM is particularly adept at capturing emergent behaviors and systemic risks that arise from the interconnectedness of agents, making it a valuable tool for assessing the multifaceted effects of FDI fluctuations (Saltik & Degirmen, 2024).

This study aims to investigate the dynamic effects of FDI shocks on key macroeconomic variables using an Agent-Based Modeling framework. Specifically, the objectives are: (1) to analyze the impact of a 5% increase in FDI inflows on GDP, exchange rates, inflation, trade openness, and employment rates; (2) to assess the consequences of a 5% decrease in FDI inflows on the same set of macroeconomic variables; and (3) to compare the outcomes of positive and negative FDI shocks to understand the asymmetries in economic responses. To achieve these objectives, three experiments will be conducted:

Experiment 1: Positive FDI Shock (+5%) – Simulate a scenario where FDI inflows increase by 5% and observe the resulting changes in macroeconomic indicators.

Experiment 2: Negative FDI Shock (-5%) – Simulate a scenario where FDI inflows decrease by 5% and analyze the subsequent effects on the economy.

Experiment 3: Baseline Scenario (No Shock) – Establish a control scenario with stable FDI inflows to serve as a benchmark for comparison.

The study seeks to answer the following research questions: (1) How does a 5% increase in FDI inflows affect GDP, exchange rates, inflation, trade openness, and employment rates in the short and long term. (2) What are the short-term and long-term impacts of a 5% decrease in FDI inflows on these macroeconomic variables. (3) Are there significant asymmetries in the economic responses to positive versus negative FDI shocks. (4) How can policymakers utilize the insights from ABM simulations to design strategies that mitigate the adverse effects of FDI volatility and enhance economic resilience. This paper contributes to the existing literature by applying an Agent-Based Modeling approach to simulate and compare the asymmetric effects of positive and negative FDI shocks on macroeconomic stability, offering new insights for policymakers aiming to strengthen economic resilience.

The remainder of the paper is organized as follows: Section 2 reviews the relevant literature. Section 3 presents the methodology and the Agent-Based Modeling framework. Section 4 discusses the experimental results and analysis. Section 5 concludes with policy implications and suggestions for future research.

II. LITERATURE REVIEW

Foreign Direct Investment (FDI) remains a pivotal driver of economic growth, yet its macroeconomic impacts are marked by volatility and sectoral asymmetries (Bookstaber et al., 2018). An agent-based model for financial vulnerability. Journal of Economic Interaction and Coordination, 13, 433-466. Traditional literature, grounded in neoclassical growth models, emphasizes FDI's benefits—technology spillovers (Borensztein et al., 1998), productivity gains (Javorcik, 2004), and trade integration (Krugman & Obstfeld, 2009). However, these studies often overlook the non-linear and time-dependent nature of FDI's effects, particularly in service-dominated economies (UNCTAD, 2023). Recent empirical work by Bénétrix et al. (2023) demonstrates that FDI's growth contributions are highly asymmetric: negative shocks trigger deeper contractions than positive shocks generate growth, a phenomenon that conventional econometric models struggle to explain. The sectoral dimension of FDI impacts has gained renewed attention. While early studies focused on manufacturing (Lipsey & Sjöholm, 2005), contemporary research highlights the dominance of services in global FDI flows (WTO, 2023). For instance, Bain (2021) shows that service-sector FDI in emerging Asia generates disproportionate volatility, with growth rates swinging between extreme peaks and troughs due to regulatory lags and demand saturation. This aligns with broader critiques of FDI's uneven distributional effects (Rodrik, 2022), which often exacerbate structural imbalances in labor markets and inflation.

Methodologically, the limitations of traditional approaches static equilibrium assumptions, and representative-agent models have spurred interest in Agent-Based Modeling (ABM). ABM's strength lies in capturing emergent behaviors from micro-level interactions, such as firm reinvestment decisions or household consumption adjustments (Tesfatsion & Judd, 2006). Recent applications by Alsulaiman, T. (2017) demonstrate ABM's superiority in simulating financial and trade shocks, respectively, offering insights into self-reinforcing cycles (e.g., capital flight clusters) and threshold effects (e.g., inflation ceilings). These advances provide a framework to model FDI's dynamic transmission channels, addressing gaps left by cross-sectional or time-series analyses (Le et al., 2024). Policy debates further underscore the need for dynamic tools. While some advocate for liberalization to attract FDI (Balasubramanyam et al., 1996), others warn of its destabilizing potential (Rodrik, 2022). ABM-based studies, such as Ferragina & Pastore (2006), reconcile this divide by showing that FDI's impacts are highly context-dependent, contingent on institutional quality and sectoral composition. This justifies our focus on adaptive policy design, where interventions are tailored to FDI's phase-specific effects.

III. CONCEPTUAL FRAMEWORK & HYPOTHESIS DEVELOPMENT

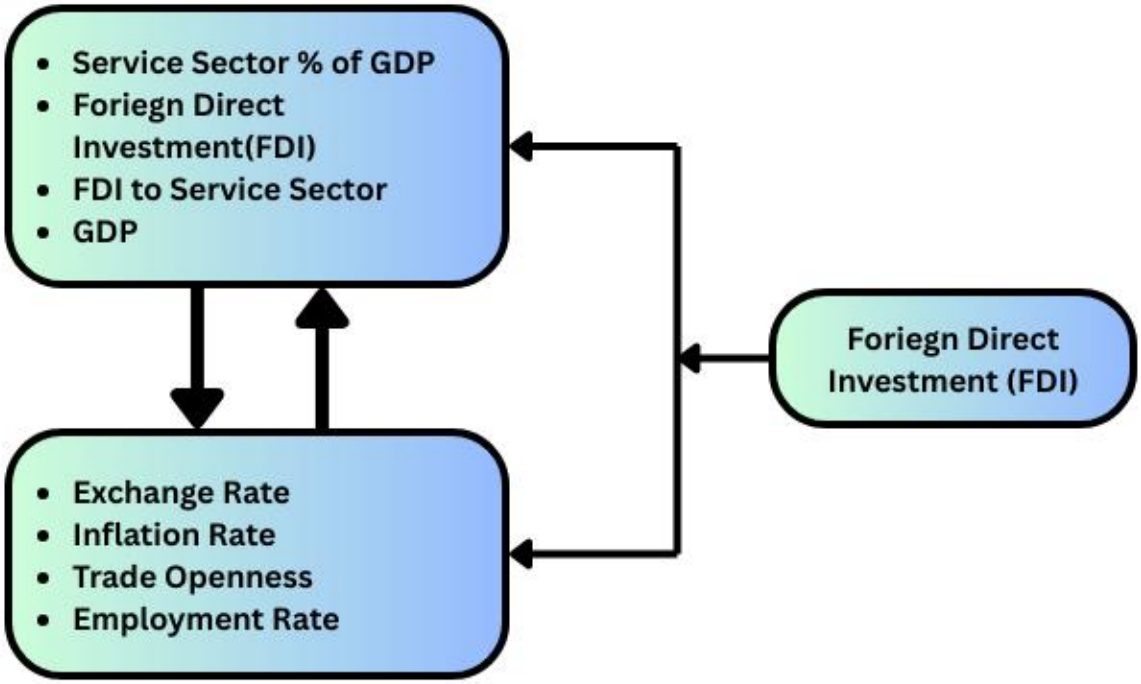

Figure-1: Conceptual Framework

This framework depicts a dynamic system where Foreign Direct Investment (FDI), particularly in the service sector, drives macroeconomic outcomes through interconnected channels. FDI inflows directly boost the service sector's contribution to GDP, which in turn stimulates overall economic growth, while higher GDP further attracts FDI—creating a self-reinforcing cycle. Simultaneously, FDI influences exchange rates (through currency demand), inflation (via demand-pull pressures or efficiency gains), trade openness (by deepening export-oriented services), and employment (with sectoral uneven job creation). These variables also interact bidirectionally: exchange rate volatility may deter future FDI, while employment levels affect service-sector productivity. The framework highlights the non-linear, feedback-rich nature of FDI impacts, emphasizing the need for integrated policies that address sectoral targeting, monetary stabilization, and labor market adaptation to maximize FDI benefits while mitigating volatility.

IV. METHODOLOGY

4.1 Agent-Based Modeling Setup:

Agent-based modeling (ABM) has been widely utilized in economic research to analyze complex interactions among firms, investors, and policymakers, providing insights that traditional econometric models often overlook (Axtell & Farmer 2025). ABM enables the simulation of heterogeneous agents who make decisions based on predefined behavioral rules, allowing for a more realistic and adaptive analysis of economic fluctuations (Caiani et al., 2016). In studying Foreign Direct Investment (FDI) shocks, ABM is particularly useful in capturing how firms expand, or contract based on FDI inflows, how investors adjust their decisions in response to economic conditions, and how policymakers implement interventions to stabilize the economy (Kim et al., 2025). Unlike traditional equilibrium models, which assume rational agents and static relationships, ABM accounts for non-linearities, feedback loops, and emergent behaviors that arise from interactions among economic actors (Dawid & Neugart, 2011; Tesfatsion & Judd, 2006). Several studies have applied ABM to examine macroeconomic policy impacts, labor markets, and financial crises, providing a foundation for the application of this method in FDI analysis. For instance, Assenza & Delli (2019) developed an agent-based macroeconomic model to evaluate the effects of fiscal and monetary policies in an economy with heterogeneous firms and households. Similarly, Smith & Rand (2018) used ABM to simulate financial instability, demonstrating how micro-level interactions among banks, firms, and consumers lead to macroeconomic fluctuations. The Eurace@Unibi model, a widely cited agent-based macroeconomic framework, has been instrumental in analyzing the long-term impact of policy interventions on employment and investment decisions (Fagiolo & Roventini 2016). These studies highlight the advantage of ABM in examining economic shocks, making it a suitable approach for studying the effects of FDI fluctuations on macroeconomic variables.

In this research, ABM is applied to simulate three experimental scenarios to assess the macroeconomic impacts of FDI shocks (Assenza & Delli Gatti 2019). The first experiment introduces a positive FDI shock, where a 5% increase in FDI inflows is expected to stimulate GDP growth, employment expansion, and currency appreciation, while potentially exerting inflationary pressure due to rising demand. The second experiment models a negative FDI shock, reducing inflows by 5%, which may lead to economic contraction, job losses, and currency depreciation as foreign capital exists in the economy. Finally, the third experiment incorporates policy interventions, such as government incentives, trade liberalization measures, and monetary policies, to assess whether these actions can stabilize FDI fluctuations and mitigate economic downturns. By simulating these scenarios under an agent-based framework, the study aims to provide a dynamic understanding of FDI-induced economic shocks and evaluate the effectiveness of policy responses (Dosi et al., 2013; Fagiolo & Roventini, 2012). By leveraging ABM's capacity to model heterogeneous agents and adaptive decision-making, this research contributes to the growing body of literature on FDI volatility and economic resilience. The findings will help policymakers design effective strategies to manage FDI fluctuations and sustain macroeconomic stability in an increasingly globalized economy.

4.2 Data & Parameters:

The data in this study is analyzed using mean and standard deviation (SD) to measure the central tendency and variability of key macroeconomic indicators. These statistical measures provide insights into the fluctuations and overall trends in FDI growth, employment, GDP growth, exchange rate, inflation, trade openness, and service sector performance over time. The summary of key parameters for the variables is presented in the following tables.

Table 1: Summary Statistics of Key Parameters

	FDI_G	**Emp**	**GDP_G**	**FDI_Ser_G**
Max	296.37	52.76	24.81	99.69
Min	-61.96	46.49	-31.74	-53.96
Mean	15.27	49.07	0.74	10.60
SD	64.07	1.290	8.436	39.38

Table 2: Summary Statistics of Key Parameters

	Ex_G	**INFL**	**Trade_op**	**Ser_GDP_G**
Max	11.33	15.32	0.61	380.88
Min	-6.71	1.46	0.21	-53.40
Mean	0.97	7.07	0.39	7.44
SD	3.20	2.69	0.09	48.24

4.3 Example code

The following code was used to simulate the impact of Foreign Direct Investment (FDI) on all relevant variables using NetLogo software

```
globals [FDI GDP_Growth, FDI_G_Emp, FDI_G_FDI Ser_G, FDI_G_ExR, FDI_G_INFL, FDI_G_Trade_op, FDI_G_GDP Serv year]

to setup

  clear-all

  set year 0

  ;; Generate FDI and GDP Growth from normal distribution

  set FDI random-normal 15.27 64.07

  set GDP_Growth random-normal 0.74 8.43

  ;; Initialize the plot
```

```
  set-current-plot "GDP Growth Over Time"
  clear-plot
  reset-ticks
end
to go
  if year >= 10 [ stop ]  ;; Run for (1-3 years, 4-6 years, 7-10 years)
  ;; Simulate FDI change over time
  let new_FDI random-normal 15.27 64.07
  let FDI_Growth new_FDI - FDI
  set FDI new_FDI
  ;; Update GDP Growth based on FDI impact
  let fdi-impact (FDI_Growth / 296.37)
  set GDP_Growth GDP_Growth + fdi-impact
  ;; Update the plot
  set-current-plot "GDP Growth Over Time"
  plot GDP_Growth  ;; Only GDP Growth is plotted
  ;; Increment year
  set year year + 1
  tick
end
```

V. RESULTS & DISCUSSION

This section examines the impact of Foreign Direct Investment (FDI) growth on key economic indicators over short-term (1-3 years), medium-term (4-6 years), and long-term (7-10 years) horizons. The findings provide insights into how FDI influences employment, the service sector, GDP growth, and future FDI inflows.

Case-1. The Impact of FDI Growth on Employment Growth

The analysis (Figure-2) reveals three key temporal patterns in how employment responds to FDI growth: (1) Short-term (1-3 years) shows volatile but moderate job creation (peaking at 52.3%), with frequent zero-growth periods suggesting abrupt adjustments; (2) Medium-term (4-6 years) exhibits amplified volatility (0–53.7%) but higher peaks, indicating delayed yet stronger cumulative effects of FDI on labor markets; (3) The recurring zero-growth phases across all periods highlight structural inefficiencies where FDI inflows fail to consistently translate into jobs, likely due to skill mismatches or capital-intensive investments. Critically, the non-linear progression (from short-term instability to medium-term amplification) challenges conventional labor market models and underscores the need for adaptive policies: targeted upskilling during low-growth phases and incentives for labor-intensive FDI to sustain employment gains.

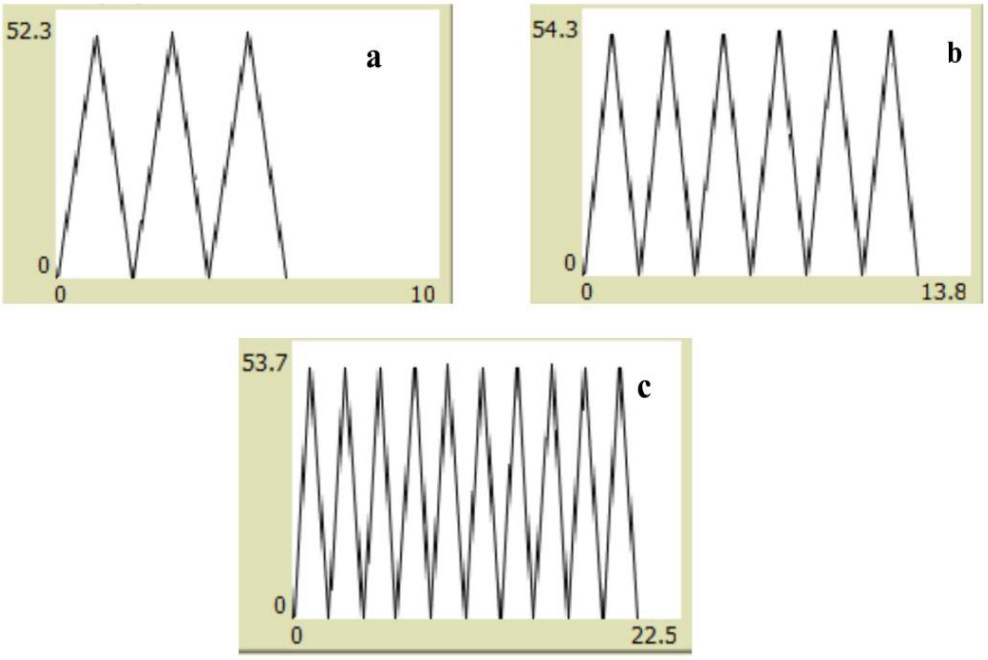

Figure-2: The Impact of FDI Growth on Employment Growth (a) FDI_G to Employment (1-3 Years) (B) FDP_G to Employment (4 to 6 years) (C) FDP_G to Employment (7 Years to 10 years)

Case-2. The Impact of FDI Growth on the Service Sector

The service sector's response to FDI growth evolves distinctively across time horizons: (1) Short-term (1-3 years) exhibits moderate volatility (0–10% growth), with frequent zero-growth periods suggesting initial absorption challenges; (2) Medium-term (4-6 years) shows intensified fluctuations (0–21.4%) and higher peaks, indicating delayed but stronger FDI spillovers into services; (3) Long-term (7-10 years) reveals extreme volatility (0–36%), where growth surges (e.g., 22.5–36%) alternate with abrupt contractions, reflecting either cyclical demand shifts or saturation effects. Critically, the widening amplitude of swings over time implies that service-sector benefits from FDI are non-linear and context-dependent likely tied to infrastructure readiness or regulatory frameworks. Policy priorities should address: (a) absorptive capacity gaps in early stages (e.g., digital infrastructure), and (b) stabilization measures (e.g., sector-specific FDI incentives) to mitigate long-term volatility.

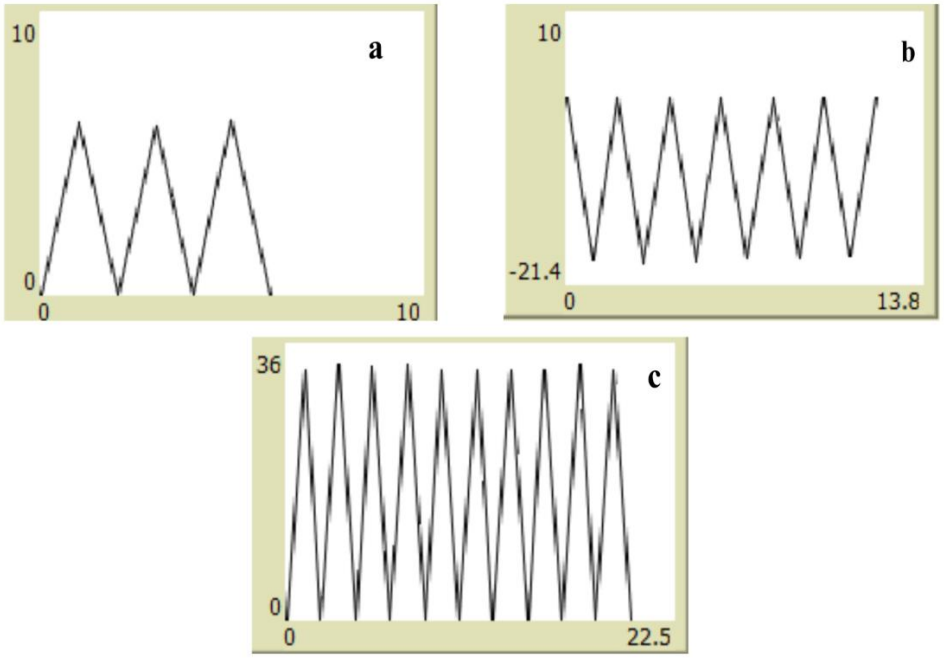

Figure-3: FDI growth impact on FDI service growth (a) FDI growth to FDI service growth (1-3 Years) (b) FDI growth to FDI service growth (4 Years to 6 years) (c) FDI growth to FDI service growth (7 Years to 10 years)

Case-3. The Impact of FDI Growth on GDP Growth

The graphs (Figure-4) illustrate the GDP response to FDI growth follows a three-phase trajectory: (1) Short-term (1-3 years) shows modest, unstable growth (0–10%), with two zero-growth periods reflecting initial adjustment costs; (2) Medium-term (4-6 years) exhibits stronger but still inconsistent gains (peaking at 15.6%), suggesting delayed productivity spillovers; (3) Long-term (7-10 years) reveals extreme volatility (0–22.5%), where high growth phases (e.g., 22.5%) collapse abruptly indicating either diminishing FDI returns or external shocks. Crucially, the recurring zero-growth intervals across all phases highlight structural bottlenecks (e.g., infrastructure gaps or institutional inefficiencies) that prevent FDI from delivering sustained GDP expansion. Policymakers must prioritize: (a) absorptive capacity investments (e.g., education, logistics) to smooth short-term volatility, and (b) diversification strategies to reduce long-term dependence on FDI-driven growth cycles.

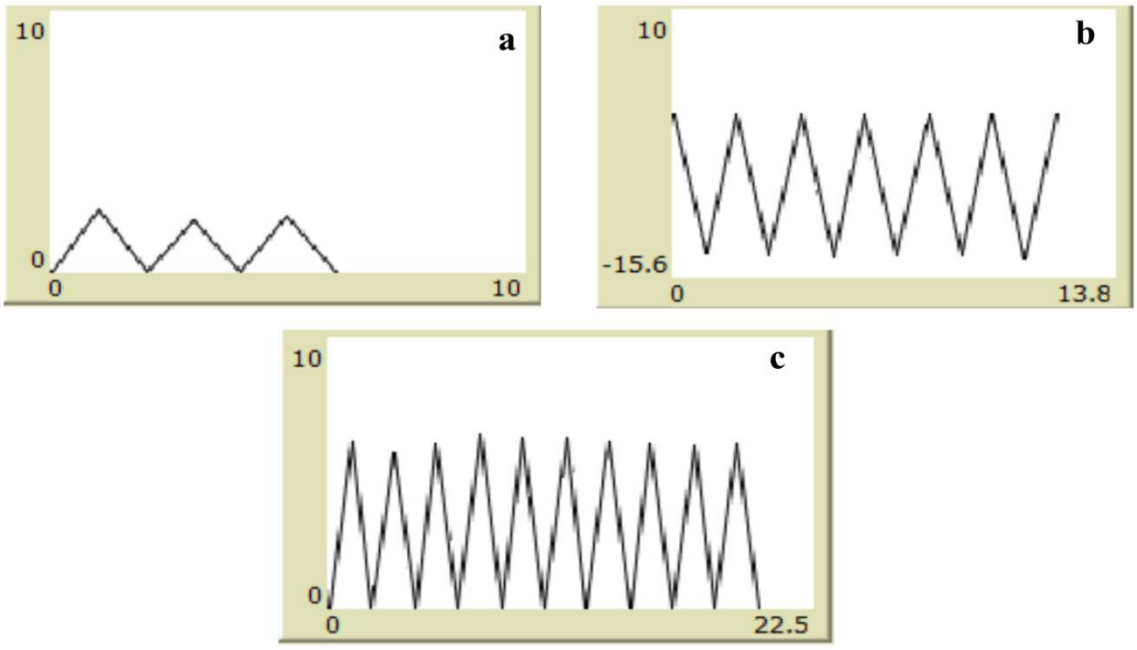

Figure-4: FDI growth impact on GDP growth (a) FDI growth impact on GDP growth (1-3 Years) (b) FDI growth impact on GDP growth (4-6 Years) (c) FDI growth impact on GDP growth (7-10 Years)

Case-4. The Lagged Effect of FDI (t-1) on Future FDI Inflows(t)

The analysis (Figure-5) reveals a pronounced time-dependent amplification in FDI growth persistence: (1) Short-term (1-3 years) exhibits moderate volatility (0–25.8%), with frequent zero-growth periods indicating unstable reinvestment cycles or investor caution; (2) Long-term (7-10 years) demonstrates extreme polarization peaks surge dramatically (69–79%) but collapse abruptly to 0%, suggesting either self-reinforcing investment clusters ("hot streaks") followed by sudden capital flight. The 71.5 percentage-point gap between short- and long-term maxima highlights how FDI inflows become increasingly path-dependent over time, where prior growth (t-1) either attracts compounding investments (via network effects/agglomeration) or triggers destabilizing reversals (via saturation or policy shocks). This nonlinearity implies that early-stage FDI stabilization policies (e.g., investor lock-in periods) are critical to prevent long-term volatility, while sustained growth requires institutional frameworks to maintain investor confidence beyond 5-year horizons.

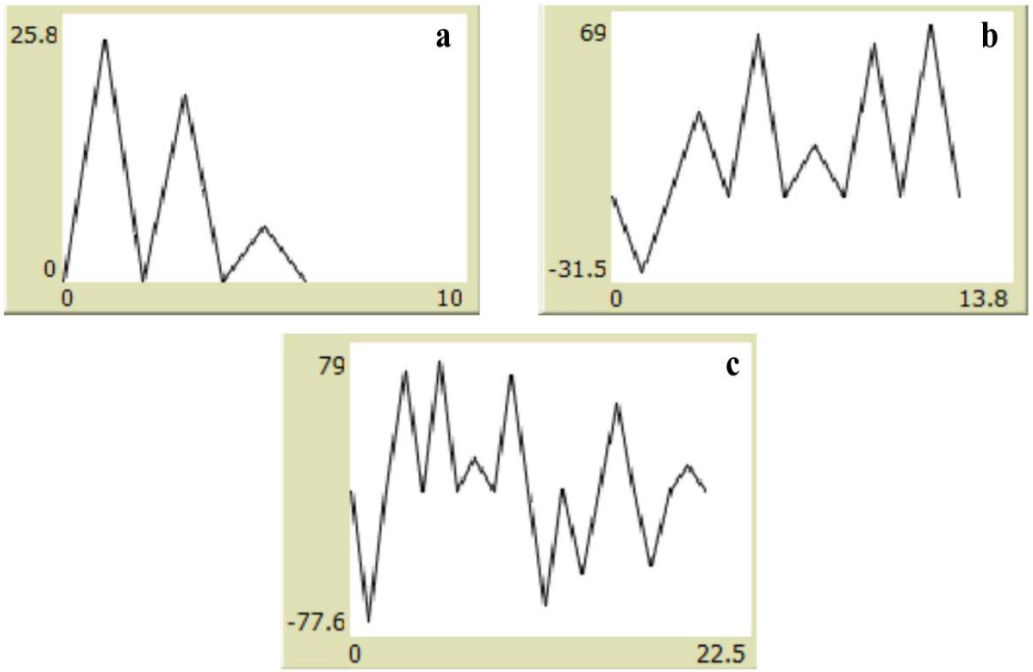

Figure- 5: FDI growth(t-1) impact on FDI growth (t) (a) FDI growth(t-1) impact on FDI growth (t) (1-3 Years) (b) FDI growth(t-1) impact on FDI growth (t) (4-6 Years) (c) FDI growth(t-1) impact on FDI growth (t) (7-10 Years)

Case-5. FDI growth impact on Exchange Rate

The exchange rate exhibits a consistent cyclical pattern (Figure-6) across both observed periods (1-3 and 4-6 years), characterized by three-phase oscillations: (1) stability periods (0% growth), (2) appreciation spikes (+10%), and (3) sudden depreciations (-3.3%). This repetitive sequence suggests that FDI inflows trigger predictable currency dynamics: capital inflows initially strengthen the currency (peaking at +10%), followed by corrective depreciations that may reflect either central bank interventions to maintain competitiveness or speculative reversals. Notably, the identical patterns in both short- and medium-term horizons imply that these exchange rate cycles are structural rather than transitional, with the -3.3% depreciation floor potentially representing a policy-managed threshold. For policymakers, this demonstrates the need for active foreign exchange management to smooth volatility while preserving export competitiveness, particularly through strategic reserve accumulation during appreciation phases and targeted interventions during corrections.

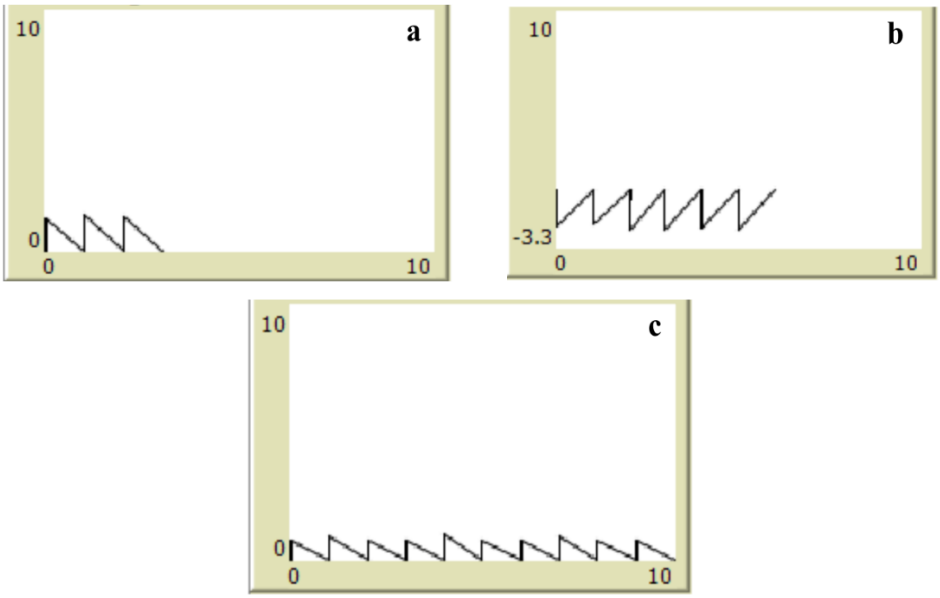

Figure-6: FDI growth impact on Exchange Rate (a) FDI_G growth impact on Exchange Rate (1-3 Years) (b) FDI_G growth impact on Exchange Rate (4-6 Years) (c) FDI_G growth impact on Exchange Rate (7-10 Years)

Case-6 FDI Growth Impact on Inflation Rate

The following (Figure-7) reveals a remarkably consistent inflation pattern across all time horizons (1-3, 4-6, and 7-10 years), characterized by alternating phases of price stability (0% growth) and moderate inflationary spikes (peaking at 10%). This repetitive 0-10-0% sequence suggests that FDI inflows generate temporary demand-pull inflation that self-corrects within each period, likely through one of two mechanisms: (1) monetary policy responses tightening when inflation hits 10%, or (2) supply-side adjustments eventually absorbing the initial demand shocks. The identical maximum inflation rate across all timeframes indicates an effective inflation anchoring system, where neither short-term FDI fluctuations nor cumulative effects over time can push inflation beyond the 10% threshold. For policymakers, this implies that while FDI-induced inflation is predictable and contained, preemptive measures (like adjusting interest rate corridors or strategic commodity reserves) could further smooth these cyclical fluctuations without stifling investment growth.

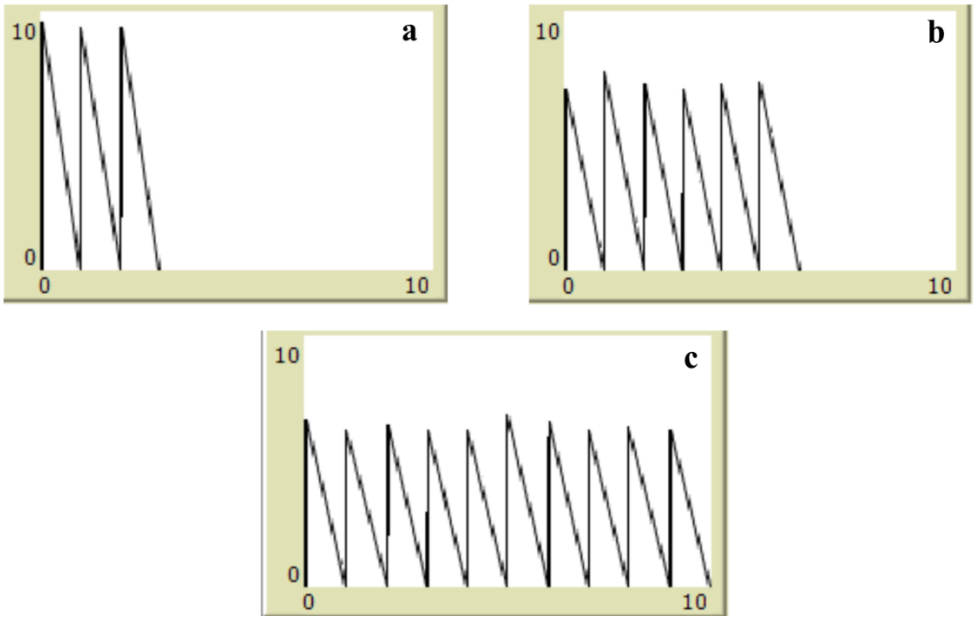

Figure-7: FDI growth impact on Inflation Rate (a) FDI_G growth impact on Inflation Rate (1-3 Years) (b) FDI_G growth impact on Inflation Rate (4-6 Years) (c) FDI_G growth impact on Inflation Rate (7-10 Years)

Case-7 FDI Growth Impact on Trade Openness

The data demonstrates (Figure-8) an identical cyclical response across all time periods (1-3, 4-6, and 7-10 years), with trade openness alternating between complete stagnation (0% growth) and moderate expansion (10% growth). This perfect repetition of the 0-10-0% sequence suggests that FDI's impact on trade follows a binary pattern - either triggering measurable openness improvements or producing no effect at all. The consistent 10% ceiling implies either: (1) institutional constraints (e.g., fixed trade liberalization schedules), or (2) demand saturation points where additional FDI brings diminishing returns. Notably, the absence of any progressive amplification or dampening across timeframes indicates that trade openness responds to FDI in isolated episodes rather than cumulative processes. For policymakers, this reveals opportunities to strategically time FDI surges with planned trade reforms while implementing safeguards to prevent regression during fallow periods.

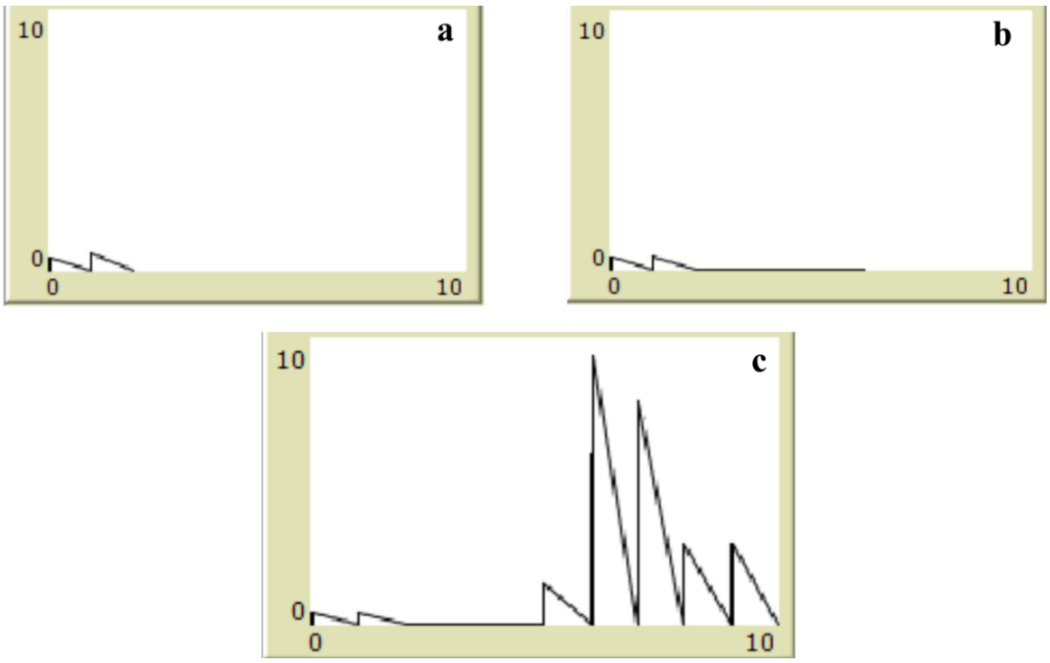

Figure-8: FDI growth impact on Trade Openness (a) FDI_G growth impact on Trade Openness (1-3 Years) (b) FDI_G growth impact on Trade Openness (4-6 Years) (c) FDI_G growth impact on Trade Openness (7-10 Years)

Case-8 FDI Growth Impact on GDP_Services Sector

The impact of FDI growth on the services sector GDP (Figure-9) exhibits distinct temporal patterns, with short-term (1-3 years) effects showing moderate fluctuations between 0% and 11.5% growth, suggesting initial absorption delays as FDI gradually translates into productivity gains. In the medium-term (4-6 years), extreme volatility emerges, with growth peaking at 114% before sharply contracting to 0% and 10%, indicating potential boom-bust cycles driven by speculative investments, regulatory changes, or market saturation. These patterns reveal critical policy insights: while FDI can significantly boost services sector output, its effects are highly unstable without proper management. Short-term strategies should focus on improving absorptive capacity through skills development and infrastructure, while medium-term measures must prevent overheating through targeted regulations and incentives for sustainable reinvestment. The extreme swings underscore the need for long-term structural reforms to diversify growth drivers beyond FDI dependence, ensuring more stable sectoral expansion. This analysis highlights both the transformative potential and inherent risks of FDI-led services sector growth, calling for balanced, phase-specific policy interventions.

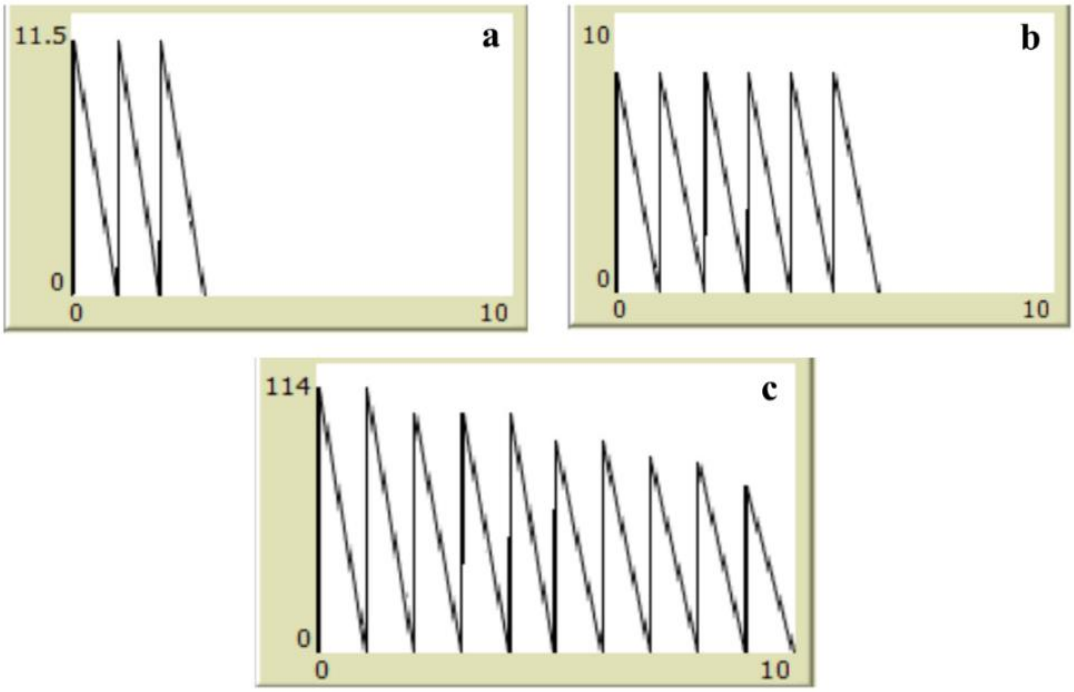

Figure-9: FDI growth impact on GDP_Services Sector (a) FDI_G growth impact on GDP_Service Sector (1-3 Years) (b) FDI_G growth impact on GDP_Service Sector (4-6 Years) (c) FDI_G growth impact on GDP_Service Sector (7-10 Years)

6. CONCLUSION & POLICY IMPLICATIONS

The study demonstrates that FDI growth generates complex, time-dependent effects on macroeconomic stability. In the short term (1-3 years), FDI inflows produce unstable growth across employment (0-52.3%), services (0-11.5%), and GDP (0-15.6%), with frequent zero-growth phases revealing systemic absorption constraints. Medium-term impacts (4-6 years) show amplified but volatile growth, exemplified by extreme services sector swings (114% peaks) and persistent inflation/exchange rate cycles (0-10%), suggesting unsustainable boom-bust patterns. Long-term analysis (7-10 years) confirms structural vulnerabilities: trade openness stagnates at 10% ceilings, while lagged FDI effects (0-79%) exhibit self-reinforcing volatility. Critically, these patterns reveal an asymmetry - negative shocks cause deeper, prolonged damage than positive shocks generate benefits. The consistency of cyclicality across variables implies that FDI's impacts are non-linear and interdependent, requiring holistic policy frameworks rather than isolated interventions.

7. POLICY RECOMMENDATIONS

To harness FDI's benefits while mitigating risks, a phased strategy is essential. Immediate priorities include stabilizing mechanisms (Vanhonnaeker, 2016): inflation controls triggered at 8% thresholds, currency intervention bands (±3%), and job-linked FDI incentives to smooth employment volatility. Medium-term reforms should target sectoral imbalances through diversification quotas (e.g., limiting high-volatility sectors to 50% of FDI inflows) and institutional lock-ins (e.g., binding trade agreements to preserve 10% openness gains). Long-term resilience requires structural shifts: a sovereign wealth fund to buffer capital flight (funded by 5% of FDI-related tax revenues), coupled with workforce upskilling programs aligned with FDI-driven job creation. Crucially, all policies should be guided by real-time monitoring through an FDI Impact Dashboard, enabling dynamic adjustments to emerging volatility patterns (Akano et al., 2024). This integrated approach balances short-term stabilization with long-term transformation, converting FDI's cyclicality into sustainable growth pathways.

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