ESTIMATING COMPETITION IN MICROFINANCE USING STATA: A STOCHASTIC FRONTIER AND DYNAMIC PANEL GMM APPROACH

Pooja Khari

(PhD scholar in Economics)

Indian Institute of Foreign Trade)

KEY INSIGHTS INTO THE CHAPTER

Objective: Explore competition dynamics in microfinance across three groups of developing countries from 2010 to 2019 using the Boone index built entirely in Stata.

Data Sources: Used data from MIX and World Bank indicators to estimate a translog cost function using a stochastic frontier model.

Methodology: Used two-step GMM to estimate marginal cost parameters and competition levels over time.

Key Findings:

- The majority of countries exhibit consecutive negative Boone values, indicating robust competition.
- Upper developing countries demonstrate strong competition over longer periods, while lower developing countries show lower competition.
- India and Bangladesh consistently maintain high competition levels compared to their peers.
- An anomalous positive coefficient in 2016 suggests potential market collusion or strategic responses in India as a result of a regulatory policy or an economic shock.

Graphical Representation: Illustrate the evolution of competition, highlighting periods of increasing and decreasing competitiveness across different country groups.

Implications: Insights into competition dynamics inform policymakers and industry stakeholders in fostering a healthy and competitive microfinance ecosystem.

INTRODUCTION

Microfinance Evolution:

- Shift from NGO dominance to for-profit entities globally, notably NBFCs.
- Commercial investment influx, with banks catering to low-income populations-downsizing
- In India, NBFC-MFIs control significant loan portfolios, signaling sector growth.

Challenges Faced:

- Competition drives innovation but leads to issues like **multiple borrowing and repayment challenges**.
- Balancing financial sustainability with social mission poses a challenge (Mission Drift).
- Commercialization in India **sparks investment surge and over-lending concerns.**

Global Recognition and Growth:

- Microfinance's global recognition, marked by UN's declaration of 2005 as 'International Year of Microcredit'.
- Nobel Peace Prize for Grameen Bank and Dr. Muhammad Yunus boosts commercialization.
- *Commercialization expands MFIs' reach, reducing reliance on grants and subsidies.*

Analyzing Competition Dynamics:

- Crucial to examine competition evolution amidst regulatory changes and market dynamics.

LIT REVIEW

- **Commercialization and Competition**: The process of commercialization within microfinance institutions (MFIs) intertwines closely with competition dynamics, as MFIs seek to diversify funding sources and enhance competitiveness. Commercialization empowers MFIs to tap into commercial funding streams, expand revenue sources, and compete effectively in the market (Armendariz & Morduch, 2010).
- **Measurement of Competition**: The measurement of competition within the microfinance sector has gained significance due to factors like substantial sector growth, the presence of for-profit MFIs, and the adoption of the self-sustainability model. Increased competition poses challenges such as moral hazard, information asymmetry, and borrower repayment issues, impacting both MFIs and clients (McIntosh et al., 2005; Schicks & Rosenberg, 2011).
- **Approaches to Assess Competition**: Researchers employ both structural and non-structural approaches to gauge competition within microfinance. Structural approaches evaluate competition through market structure tests, while non-structural approaches infer behavior from estimated parameters. Common measures include concentration indices, revenue tests, and the Lerner index (Baquero et al., 2012; Assefa et al., 2013).
- **Challenges and Impacts of Competition**: Heightened competition within the microfinance sector affects borrower quality, loan defaults, interest rates, profitability, efficiency, and outreach efforts. The competition may lead to a decline in borrower quality, reduced profitability, and challenges in maintaining outreach performance (Vogelgesang, 2003; Hartarska & Nadolnyak, 2007).
- **Indirect Methods for Estimating Competition**: Due to data unavailability, researchers use indirect methods to estimate market competitiveness within microfinance. These methods include concentration indices, revenue tests, and measures based on borrower behavior, lending group characteristics, and proximity of competitors (Olivares-Polanco, 2005; McIntosh et al., 2005).

CONTI...

- **Critique of Structural Approach**: While structural approaches like concentration indices provide insights into market power, they lack robust support from microeconomic theory and face criticism for their deficiencies. Consequently, non-structural approaches, such as the NEIO framework, have gained prominence (Baquero et al., 2012).
- **Key Measures of Competition**: Measures such as the Panzar-Rosse revenue tests and the Lerner index offer insights into market power and the degree of competition. These measures assess competition based on the harmony between input and output prices, as well as the price-cost margin, respectively (Assefa et al., 2013).
- **Assessing Competition through Borrower Behavior:** Some studies evaluate competition based on borrower behavior, including the fraction of bank clients with concurrent loans from other MFIs and the number, presence, and proximity of competitors offering group loans at the lending group level (Vogelgesang, 2003; McIntosh et al., 2005).
- **Contribution of this paper:** Despite the variety of competition indicators used in previous studies, such as the Lerner index, PR H-statistics, and HHI, none have yet employed the less data-intensive Boone index to measure the competitiveness of microfinance markets across different developing economies with dense concentration of microfinance lending.

DATA SOURCES

- **Data Sources**: Utilization of MIX Market data, a prominent source for microfinance research, offering comprehensive sector insights.
- **Study Period**: Spanning a decade from 2010 to 2018, capturing longitudinal trends and changes in the microfinance landscape.
- **Country Coverage**: Encompassing 13 countries across distinct development groups: Lower developing (Bangladesh, India, Ghana, Philippines, Cambodia), Least developing (Peru, Burkina Faso, Togo), and Upper developing (China, Brazil, Ecuador, Mexico, Peru).
- **Panel Datasets**: Individual datasets constructed for each country, covering 5-10 years of MFI-reported information to ensure robust analysis-unbalanced panel
- **Observations**: The dataset comprises a substantial number of observations, spanning 2010 to 2019, distributed across three developing regions globally.
- **Country Selection**: Deliberate selection to capture regional variations in competition levels and regulatory frameworks, representing South Asia, East Asia and the Pacific, and Latin America and the Caribbean.
- **Revenue Streams**: Highlighting diverse revenue streams across countries, with examples such as Indonesian MFIs relying on micro-savings and Indian MFIs predominantly generating revenue from microloans, grouping became necessary
- **Boone Indicator:** Despite revenue variations, the Boone indicator facilitates cross-country comparisons within the same development group.
- **Population and GDP Variation**: Selected countries exhibit varying population sizes, GDPs, and microfinance sector footprints, reflecting diverse economic landscapes and market potentials.

LIT CITES FOR VARIABLES USED

Competition measures		
Boone indicator	A proxy for competition; the value of β in Eq. 4; large negative β indicates a higher competition level	Boone (2008)
Output	Measured by gross loan portfolio	Assefa et al., 2013; Hermes et al. (2011); Van Leuvensteijn et al. (2011)
cost of labour	The ratio of personnel expenses to total assets	Kar, 2016; Van Leuvensteijn et al. (2011)
cost of fund	The ratio of financial expenses to total liabilities	Kar, 2016; Van Leuvensteijn et al. (2011
cost of physical capital	The ratio of administrative expenses to total assets	Kar, 2016; Van Leuvensteijn et al. (2011)

ESTIMATION

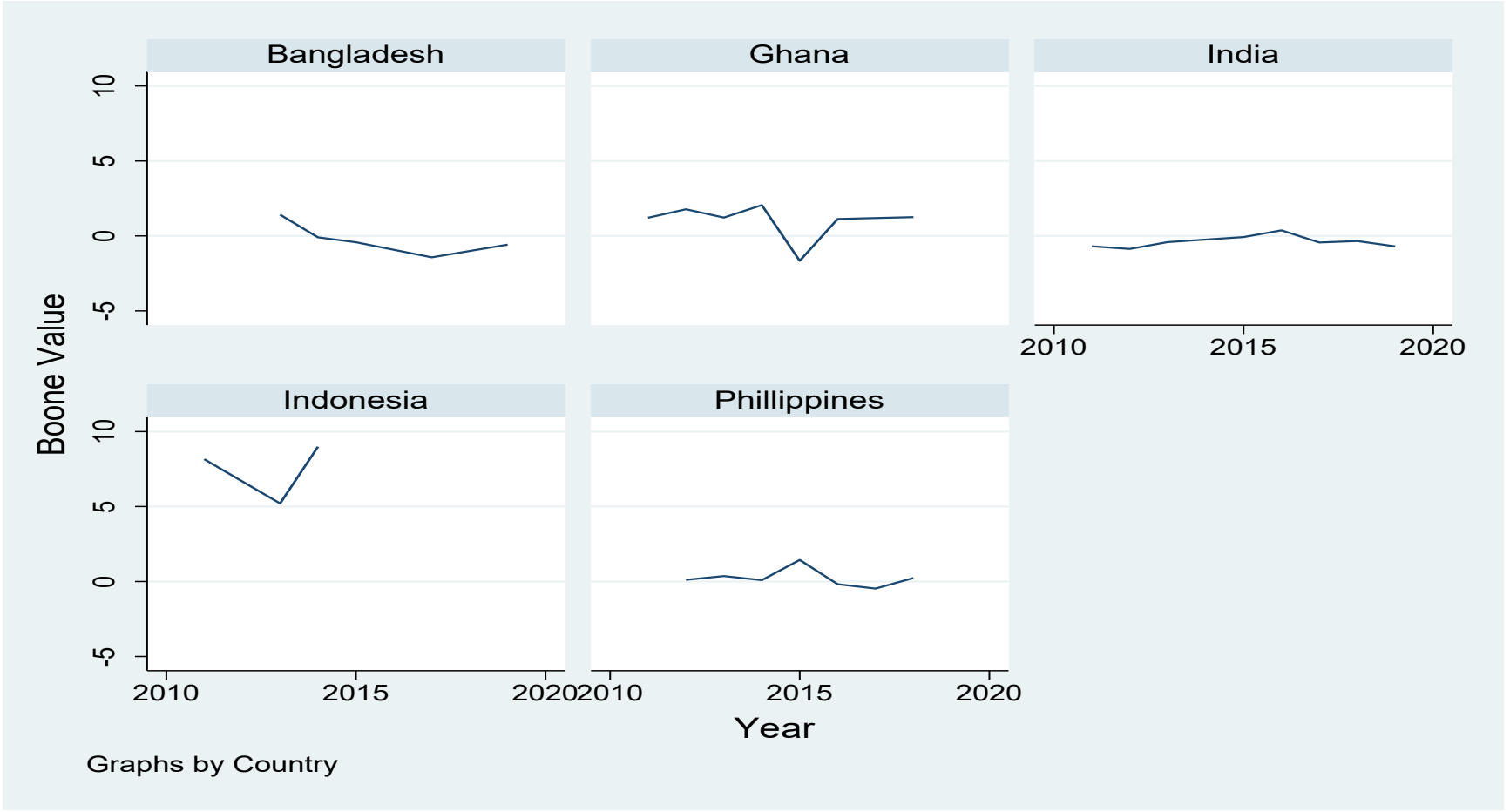
- $ln\pi_{it} = \alpha + \Sigma_{t=1}^{T} \beta_t lnMC_{it} + \varepsilon_{it}$ (1)
- $ln\pi_{it} = \alpha + \Sigma_{t=1}^{T} \beta_t d_t lnMC_{it} + \Sigma_{t=1}^{T} \alpha_t d_t + \varepsilon_{it}$ (2)
- $lnTC_{it} = \alpha_0 + \delta_0 lnq_{it} + \delta_1 (\frac{1}{2}\Sigma_{t=1}^{T} lnq_{it})^2 + \Sigma_{j=1}^{3} \alpha_j lnW_{ijt} + \Sigma_{j=1}^{2} \frac{1}{2}\alpha_j (lnW_{ijt})^2 + lnq_i \Sigma_{j=1}^{3} \alpha_{j+1} lnW_{ijt} + \frac{1}{2}\Sigma_{j,k=1}^{3} \alpha_{jk} lnW_{ijt} lnW_{ikt} + \Sigma_{t=1}^{T-1} \alpha_t d_t + \varepsilon_{it}$ (3)
- $MC_{it} = \frac{\delta TC_{it}}{\delta q_{it}} = \frac{TC_{it}}{q_{it}} (q_{it}\delta_0 + \delta_1 lnq_{it} + \Sigma_{j=1}^{3} \delta_{j+1} lnW_{ijt} + \Sigma_{t=1}^{T-1} \alpha_t d_t)$ (4)
- Equation1 –Boone Index-using GMM
- Equation 2- Boone Index with time dummies-using GMM; xtabond2 command in Stata
- Equation 3- Trans log Function(BC95)-Stochastic Frontier Model ; sfpanel command in stata

```
sfpanel lnTC lnGLP lnGLPsqby2 lnFEA lnFEAsqby2 lnADOPEA lnADOPEAsqby2 lnFEAlnADOPEA lnFEAlnGLP lnADOPEAlnGLP i.Year, model(bc95) dist(tn)
```

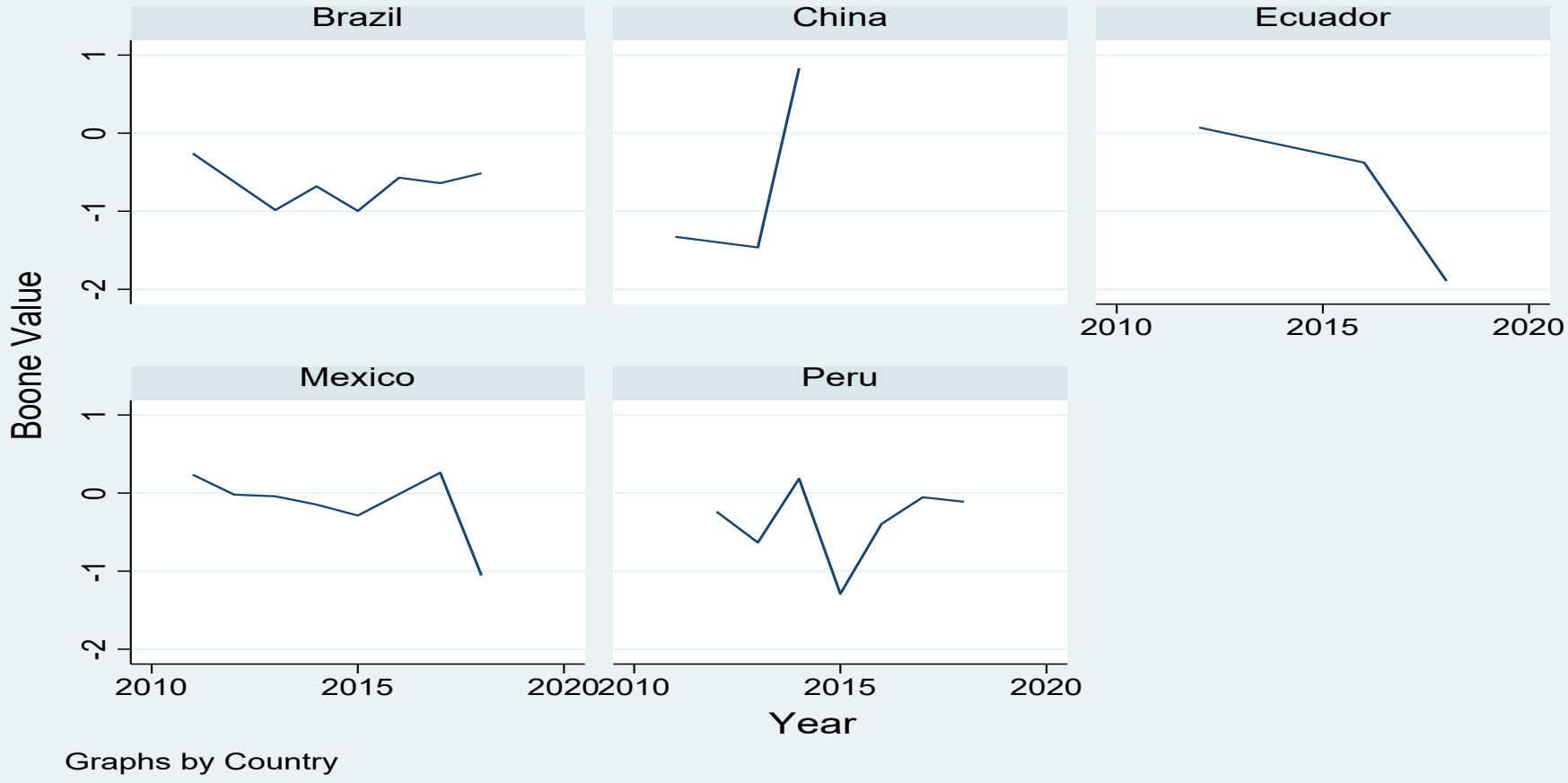
- Equation 4- used Margins equation in Stata using coefficients results (margins, expression() command in stata allows you to calculate a specific mathematical expression using estimated coefficients from your previously estimated model.

```
margins, expression((lnTC/lnGLP)*(.1790159*[lnGLP]+ .0509068*[ lnGLPsqby2 ]+ -.1144644*[ lnFEAlnGLP ]*lnFEA+ -.0482955*[ lnADOPEAlnGLP ]*lnADOPEA)) dydx(lnGLP) gen(MCF)
```

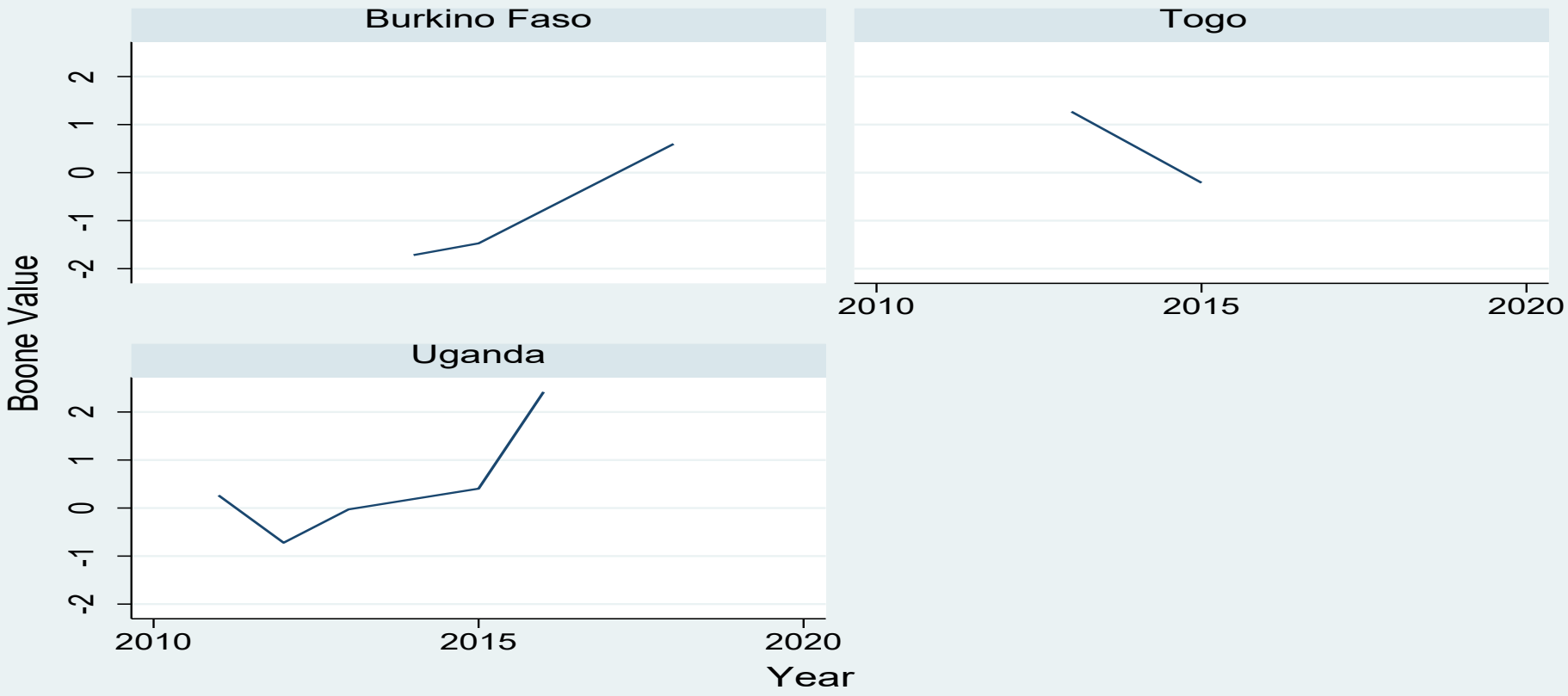
RESULTS : LOWER DEVELOPING COUNTRIES GROUP



UPPER DEVELOPING COUNTRIES GROUP



LEAST DEVELOPED COUNTRIES GROUP



ANALYSIS

- **LMI**:India: Fluctuating competition, with a notable increase in 2013 followed by market collusion in 2016 possibly due to regulatory changes.
- Bangladesh: Variation in competition levels, with peaks in 2011 and 2012 indicating heightened competition.
- Ghana: Stable competition levels with Boone values consistently around one.
- The Philippines: Fluctuating competition dynamics reflected in alternating positive and negative Boone values.
- Indonesia: Significant fluctuations in competition, with extremely high values observed in 2011 and 2014

- **UMI**:China: Mixed competition levels, significant increase in 2014 (Boone value: 0.832333) amidst relatively subdued competition in other years.
- Brazil: Fluctuating competition, notable increase in 2013 (Boone value: 0.98462) with other years showing moderate levels.
- Ecuador: Variable competition, ranging from negative to positive Boone values indicating fluctuating dynamics.
- Mexico: Relatively stable competitive environment, Boone values consistently around zero.
- Peru: Fluctuating competition, alternating between positive and negative Boone values over the specified years.

- **LD**:Uganda: Fluctuating competition levels, notable increase in 2016 (Boone value: 2.417435) indicating a low competitive market environment.
- Togo: Variable competition, slowed in 2013 (Boone value: 1.268301) with competition remaining subdued in other years.
- Burkina Faso: Predominantly negative Boone values, suggesting consistently competitive market dynamics. Significant increase in competition in 2014 (Boone value: -1.71669).

CONCLUSIONS

- Introduction of the Boone indicator for assessing competition in microfinance markets existing in emerging economies of different development statuses post-2010.
- Methodology: Use of the stochastic frontier approach to estimate marginal costs and calculate the Boone indicator.
- Advantages of the Boone indicator: Provides specific yearly observations for microfinance markets, **less data-intensive**.
- Findings: Significant variation in competition observed across thirteen dynamic microfinance markets.
- **India and Bangladesh emerge as the most competitive in the lower-income group**; declines seen elsewhere.
- **Upper-income group countries show higher competitiveness in all;** least developed group exhibits least competition.
- Summary: Disparities in competitive conditions highlight unique characteristics of each group.
- Implications: Need for tailored strategies to **enhance market efficiency and sustainability** based on observed competition dynamics.

- xtset MFIID Year
- bysort MFIID:ipolate GrossLoanPortfolioFAMIXGRL Year, generate(GLP)
- sum GLP
- sum GrossLoanPortfolioFAMIXGRL
- bysort MFIID:ipolate Administrativeexpenseassets Year, generate(AEA) epolate
- sum AEA Administrativeexpenseassets
- bysort MFIID:ipolate Operatingexpenseassets Year, generate(OPEA) epolate
- bysort MFIID:ipolate Financialexpenseassets Year, generate(FEA) epolate
- bysort MFIID:ipolate Personnelexpenseassets Year, generate(PEA) epolate
- bysort MFIID:ipolate PersonnelexpenseFAMIXPEXP Year, generate(PE) epolate
- bysort MFIID:ipolate AdministrativeexpenseFAMIXA Year, generate(AE) epolate
- bysort MFIID:ipolate OperatingexpenseFAMIXOEXP Year, generate(OE) epolate
- bysort MFIID:ipolate Financialexpenseonfundinglia Year, generate(FEL) epolate
- bysort MFIID:ipolate TotalAssetsFAMIXTTAS Year, generate(TA) epolate
- gen lnADOPEA = log(Administrativeexpenseassets + Operatingexpenseassets/ Personnelexpenseassets)
- gen lnFEA = log(Financialexpenseassets/ Personnelexpenseassets)
- gen lnGLP = log(GrossLoanPortfolioFAMIXGRL/ Personnelexpenseassets)
- gen TE = (OperatingexpenseFAMIXOEXP +Financialexpenseonfundinglia +AdministrativeexpenseFAMIXA +PersonnelexpenseFAMIXPEXP)
- gen N_TC = (TE/ Personnelexpenseassets)

- gen lnTC = log(N_TC)
- sfpanel lnTC lnGLP lnFEA lnADOPEA ,model(tfe)
- sum lnTC lnGLP lnFEA lnADOPEA
- gen lnADOPEAsqby2 = 1/2*((lnADOPEA)^2)
- gen lnGLPsqby2 = 1/2*((lnGLP)^2)
- gen lnFEAsqby2 = 1/2*((lnFEA)^2)
- gen lnFEAlnADOPEA = lnFEA*lnADOPEA
- gen lnFEAlnGLP = lnFEA*lnGLP
- gen lnADOPEAlnGLP = lnADOPEA*lnGLP
- sfpanel lnTC lnGLP lnGLPsqby2 lnFEA lnFEAsqby2 lnADOPEA lnADOPEAsqby2 lnFEAlnADOPEA lnFEAlnGLP lnADOPEAlnGLP i.Year, model(bc95) dist(tn)
- margins, expression((lnTC/lnGLP)*(.1790159*[lnGLP]+ .0509068*[lnGLPsqby2]+ -.1144644*[lnFEAlnGLP]*lnFEA+ -.0482955*[lnADOPEAlnGLP]*lnADOPEA)) dydx(lnGLP) gen(MCF)
- bysort MFIID:ipolate ReturnonassetsFAMIXRTA Year, generate(ROA) epolate
- gen lnROA = log(ReturnonassetsFAMIXRTA)
- gen lnMC = log(MCF1)
- xtsum GLP ROA TA OE FEL AE PE PEA FEA OPEA AEA
- xtreg lnROA lnMC ,fe
- estimates store fe
- xtreg lnROA lnMC ,re
- estimates store re
- hausman fe re
- xttest0
- xtabond2 lnROA L.lnMC i.Year, gmmstyle(L.lnMC, collapse lag(1 2)) ivstyle(i.Year) twostep robust small orthogonal