# Identifying High Frequency Trading activity without Proprietary Data*

***Executive Summary***

Bidisha Chakrabarty, Carole Comerton-Forde, and Roberto Pascual**

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**Abstract**

Regulators, practitioners and academics want to understand the activities of high frequency traders (HFT) and how they impact markets. However, public databases do not identify HFTs, making this pursuit difficult. To overcome this problem, researchers construct proxies using message-level data to infer the activities of HFT. We assess the reliability of eight proxies commonly used in the academic literature, by benchmarking them against HFT measures constructed from data that provide HFT identifiers. We find that all proxies are highly correlated and correctly signal HFT activities in regular times and during episodes of high/low HFT activity. Three proxies stand out from the rest. First, Hasbrouck and Saar's 2013 *Strategic Runs* metric, which identifies linked submissions, cancellations, and executions that are likely to be parts of a dynamic low-latency algorithmic strategy, is the best in isolating (overall) HFT-specific activity. Second, *Speed of Response*, the number of ultrafast responses to market quote improvements, performs better when it comes to capturing changes in HFTs' contribution to liquidity supply. Finally, *IOC* or the number of immediate or cancel orders, reliably captures changes in HFT contribution to liquidity demand.

**Keywords:** *High-frequency trading; HFT proxies; Quote intensity; Strategic Runs; Monitoring Intensity; Message traffic; Cancellations; Liquidity demand; Liquidity supply*

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* For a copy of the full paper, please contact the authors.

*☆ bidisha.chakrabarty@slu.edu; carole.comerton-forde@unimelb.edu.au; rpascual@uib.es, respectively. The authors acknowledge a grant from the NSE-NYU Stern Initiative on the Study of Indian Financial Markets. We thank Tirthankar Patnaik (Chief Economist of the National Stock Exchange of India) for expert advice on the market structure and trading protocols at the NSE. We thank Allen Carrion, Jing-Chi Chen, Linda Chen (EFMA discussant), Thierry Foucault, Lewen Guo, Joel Hasbrouck (NSE-NYU discussant), Andreas Park (NFA discussant), Andriy Shkilko (Finance Forum discussant), Konstantin Sokolov, Chen Yao (CICF discussant), and participants at the China International Conference in Finance, European Financial Management Association meetings, Indian Institute of Management (Udaipur) workshop, Northern Finance Association conference (2021), NSE-NYU Conference, NSE Workshop on Trading and Technology, University of Memphis, University of Technology (Sydney), and Women in Market Microstructure Conference for useful comments. We gratefully acknowledge guidance from Professors Joel Hasbrouck and Gideon Saar in adapting the logic of their low-latency (strategic runs) metric to our data.

High frequency traders (HFTs) contribute a significant proportion of global trading volume and it is important to understand how they affect markets.[1] To assess HFTs' impact it is necessary to identify trades by HFTs. However, public databases do not provide these identifiers. Therefore, researchers, often infer HFT activity using proxies calculated using message level data. We conduct a comprehensive examination of the popular HFT proxies used in the literature. We examine the efficacy of each proxy in identifying HFT activities, what type of HFT activities they capture, and how well they identify HFT activity during episodes of unusually high or low HFT liquidity demand or supply. We evaluate which proxy most successfully isolates activity attributable to HFTs but not to other types of traders. Finally, in cross sectional tests, we isolate proxies that can reliably distinguish between HFT liquidity demand and supply.

To do this, we run a horserace of the proxies and compare them with precisely identified HFT activity. Such identification is made possible by data from the National Stock Exchange of India (NSE), which provides trader-type identification at a message-level, time-stamped at the nanosecond frequency. These data identify whether orders are entered using the exchange-provided algorithmic order entry and management system, and further identify for each algorithmic order whether it is submitted for a proprietary account (high frequency traders or HFTs) or a client account (agency algorithm traders or AATs). Traders who do not use algorithmic order entry are the non-algorithmic traders or NATs, also identified in our data.

We assess eight popular HFT proxies: (1) *Message Traffic* (*Mess*), the number of messages, including order submissions, revisions, and cancellations; (2) *Cancellations* (*Can*), the number of limit order cancellations plus the number of revisions; (3) *Fleeting Orders* (*FleetOrd*), the number of orders cancelled or revised within 100 milliseconds of submission; (4) *Quote Intensity*

[1] The Tabb Group estimates (https://www.banking.senate.gov/imo/media/doc/TabbTestimony92012.pdf) US HFT at 55% , while the European Securities and Market Authority (ESMA, 2014) estimates HFT at 24% to 43% for equities.

(*QuoteInt*), the number of changes in the best bid quote, best ask quote, or depth at the best quotes; (5) *Flickering quotes* (*Flick*), the standard deviation of quote midpoint over 100 millisecond time intervals; (6) *Speed of Response* (*SResp*), the number of responses to quote improvements in 100 milliseconds; (7) *Strategic Runs* (*SRuns*), linked submissions, cancellations, and executions that are likely to be parts of a dynamic algorithmic strategy, counting the number of linked limit order book responses within 100 milliseconds of an improvement in the NBBO; and (8) *immediate-or-cancel* orders (*IOC*). We construct each metric in two ways – one using the HFT identifier in our data, the other without the identifier and using all messages, as it is done when other authors use proxies. We label the metrics constructed from the HFT-identified data as *true* and the ones from unidentified order flow as *proxy*.

First, we show that the HFT metrics are highly correlated with each other: Using both the *true* and the *proxy* measures, the correlation coefficients are high and statistically significant. More importantly, the correlations between each HFT *proxy* and its corresponding *true* metric are high (0.50 to 0.96) and significant at the 1% level, indicating that all the popular metrics used to represent HFT activity accurately represent true HFT activity. We next investigate which types of HFT activities these metrics capture. Using both the *true* and *proxy* metrics in regression frameworks, we find that all the HFT metrics are good at explaining *trades* in which HFTs supply liquidity as well as *trades* in which HFTs are liquidity takers. We also find that all eight proxies are good at explaining HFTs' presence (in percentage of time) at the best quotes in the limit order book (LOB) as well as to the best quoted depth.

Previous research shows that HFTs' effect on market quality may vary depending on episodes of unusually high and/or low liquidity demand and/or supply. We therefore examine how the proxy metrics perform during periods of unusually high or low HFT liquidity demand or supply

and find that all the *proxies* effectively identify HFT activity during periods of unusually high or low HFT liquidity demand as well as HFT liquidity supply. When HFT liquidity demand and liquidity supply are both low (high), all metrics reach their minimum (maximum) levels. Keeping HFT demand at low, if HFT liquidity supply (demand) increases to unusually high levels, all metrics increase. Results are analogous if HFT liquidity supply is held at unusually low and demand increases to unusually high. These patterns indicate that all the proxies correctly signal the movements of the true metrics during episodic spikes in HFT liquidity demand and/or supply.

To understand how these proxies relate to the activity of traders other than HFTs, we next include the other two trader groups – AATs and NATs in our analysis. We first examine how the HFT *proxy* metrics correlate with the analogous metrics for the AATs and NATs. Expectedly, we find that the correlation between HFTs' and AATs' order flow is much higher than the correlations between HFTs' and NATs' order flow. Notably, *SRuns* consistently shows the lowest correlations with AATs and NATs. Recall that for an HFT metric to be a "good" proxy, HFTs should be the main driver of that proxy, so lower correlation with the other trader types, especially NATs, is desirable. We then examine which proxy is driven primarily by HFT activity. To do this, we use a two-stage regression. In the first stage we run a regression, stock by stock, of each HFT *true* metric on the corresponding AAT and NAT *true* metrics and save the residuals, which can be interpreted as the component of HFT activity that is uncorrelated with AAT and NAT activities. In the second stage, we regress these residuals on the corresponding HFT *proxy* (for example, the residual of HFT *true Mess* on *Mess*). We do this in turn for AATs and NATs. The results of this exercise show that while the residual HFT metrics remain significantly correlated with all eight HFT proxies, it shows the best fit for *SRuns*. *SRuns* has the highest coefficient, the largest *t*-statistic and the highest $R^2$ in the second stage regression for HFTs, and negligible $R^2$ s of the second stage regression for

AATs and NATs. Therefore, *SRuns* is the *proxy* that is primarily driven by HFT (not AAT or NAT) activities.

Prior studies show that HFT strategies that demand liquidity can decrease liquidity by increasing adverse selection whereas HFT liquidity supply is generally found to be beneficial for markets. Therefore, it is useful to investigate if any of the HFT proxies can *distinguish* between HFT liquidity demand and supply. In the remaining part of our study, we perform cross-sectional tests to address this question. We perform a principal component analysis (PCA) using the eight HFT proxies and all the trade- and LOB-based measures of HFT contribution we have used earlier. The objective is to identify if particular proxies associate with HFT liquidity demand or supply. The exercise renders two relevant principal components (PCs) with eigenvalues greater than one. The first PC, in which *SResp* shows the highest loading, is strongly associated with HFT contribution to liquidity supply. The second PC, in which *IOC* shows the highest loading, associates well with HFT liquidity demand. We next examine how well these proxies can rank stocks according to their HFT activities, both liquidity demand and supply. Our analysis shows that *IOC* best ranks stocks by HFT liquidity demand while *SResp* outperforms all other proxies in ranking stocks based on HFT liquidity supply. Thus, the cross-sectional tests strongly support that the *IOC* metric reliably signals HFT liquidity demand and *SResp* captures liquidity supply.

Finally, researchers have a choice of aggregating data over different time windows when building proxies. Our data are timestamped to the nanosecond, so we also constructed the *true* and *proxy* metrics by aggregating data every 30 seconds all the way up to the daily level. We do not find any qualitative difference in conclusions based on the time window of data aggregation. By providing the first thorough assessment of the popular HFT proxies, we hope our work benefits academics who research HFTs, and regulators tasked with rulemaking aimed at HFTs.

# EFFECTIVENESS OF ADDITIONAL SURVEILLANCE MEASURES –EMPIRICAL STUDY USING INDIAN MARKET DATA[1]

*Dr. Latha Chari*[2], *Dr. Mohd Merajuddin Inamdar*[3]

## Background and Research Rationale

Protecting market integrity, preventing market abuse, preserving investors trust and confidence is essential for the growth and orderly development of capital markets. Market surveillance is a mechanism used by the market regulators and exchanges to monitor, detect, prevent market abuse and market manipulation. Regulators across different countries have implemented different restrictive trading practices like position limits, imposition of additional margins, price bands that cap the single-day price movements, circuit breakers and periodic call auction, rumour verification mechanism, and dissemination of information to prevent market manipulation. Despite these measures, various instances like the Game stock episode provide evidence of the fact that investor groups can collude and manipulate stock prices, which can be detrimental to market efficiency. Globally under the current regulatory framework there seems to be little room for regulators to take action against such investors. These episodes have sparked different discussions in the Indian media about the safety of investors in Capital markets.

In Indian capital markets, the regulators in addition to the above restrictive trading practices have implemented an enhanced surveillance mechanism known as the Additional surveillance measure (ASM). Trade data is monitored in real-time, and securities that exhibit abnormal price

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[2] Professor, National Institute of Securities Markets, latha.chari@nism.ac.in, Mumbai, India

[3] Lecturer, National Institute of Securities Markets, meraj.inamdar@nism.ac.in , Mumbai, India

variations concentration of trading among a few clients are shortlisted under the STASM category. When the close to close price variations of the stock is 25% more than the variations in the NIFTY 50 index for a period of 5 days on either side, and is accompanied by presence of dominating investor measured as 25 clients contributing to more than 30% of the trading volumes, the stock is classified as STASM category. Surveillance action on such stocks is that, they are subject to overall additional margins of 40% and specific additional margin of 100% to the top 10 dominating investors. The rationale for use of such trade based data as surveillance triggers, is based on widely published cases and literature related to stock price manipulations. Key characteristics of manipulated stocks documented in studies by Baoling (2021), Huang CY et. al (2005) are large spike in stock prices, high volatility, upward spike in trading volumes, short term price continuation and long term price reversals. Manipulated stocks are also generally mid or small cap stocks with low liquidity and in most cases concentration of trades among few clients is observed.

STASM surveillance action is unique in the sense that it is a pre-emptive, targeted surveillance action that is based on suspicious trade data and price patterns that are different from the recent past, where price deviations not supported by fundamental reasons. Further, the surveillance actions are specifically aimed at deterring the dominating investors. It is expected that the action will deter manipulation by increasing capital costs on the one hand and also serve as a warning to prospective investors, about the presence of abnormal trading activity in the stock which is not supported by any disclosed or known fundamental reasons.

As the surveillance intervention is unique, it is essential to understand the implications of the surveillance action on stock prices and trading activity.

## Research objectives

This study aims at ascertaining the impact of inclusion of stock into STASM category on the prices and volumes traded and liquidity. Further, the study also looks at the sustenance of such impact post exclusion of the stock from the STASM category to understand the effectiveness of the mechanism. Event study methodology is used to study the above impact. Additionally, stocks whose prices move up by more than 25% as compared to NIFTY 50 index and those that fall by 25% are both subject to the same surveillance measure. The study classifies the stock price patterns as upward, downward, continuing and reversal patterns in the pre and post inclusion periods and attempts to understand if there is any heterogeneity in impact on liquidity across

different price patterns exhibited by different stocks using a Dummy variable regression framework.

## Sample and methodology

STASM has been implemented by the exchanges in November 2018. NSE's surveillance department issued its first circular categorizing companies into STASM on 21st November, 2018, effective from 22 November, 2018. For the purpose of this study, the data of companies included or excluded from STASM along with the date of inclusion and exclusion is provided by the surveillance department of NSE. A sample set of 245 events of inclusion announcement and exclusion announcements made in the first 3 months of implementation, i.e., from 21 November, 2018 to 28th February, 2019 is used for the study. From the sample size of 245 events, companies that have carried out mergers or acquisitions in the pre-event estimation window of 120 days before the event, are excluded. Finally, we have a sample of 218 events and 188 unique companies.

The study uses the market model specified by Fama et.al. (1969) and Brown and Warner (1985) to estimate the abnormal returns in the pre and post inclusion and exclusion periods. While estimating the returns for the market model, the estimation window is considered as 120 days. The buffer period of 30 trading days was kept between the estimation window and inclusion event window. Event window was set for 5 days and 10 days before and after the events with respective stock price inclusion or exclusion from the STASM mechanism. Impact of the event on both prices and volumes is evaluated using the above model.

Liquidity is measured using turnover ratio, trade size after controlling for the size of the firm measured as log of the market capitalisation of firm. The impact of inclusion on liquidity and differential impact based on price patterns before and after inclusion is measured using a dummy variable regression framework.

The study also uses percentage shares delivered as a measure of speculative activity surrounding the event period. Higher percentage of shares delivered implies less speculation and vice versa.

## Results

Inclusion of a stock into STASM category implies the existence of price volatility and volume spikes. Event study analysis of the post inclusion price impact shows that Cumulative Abnormal returns (CAR) on the stocks fall after inclusion into STASM. Such fall in abnormal returns is sustained post exclusion also. The volume study results show that the abnormal traded volume

on stocks falls in the post inclusion period and such fall is sustained in the period following the exclusion of stock from STASM category.

The key results emerging from the regression analysis are CAR increases are accompanied by increase in cumulative abnormal volumes and increase in trade size. Stocks that are included into STASM with positive CAR have better liquidity while those with negative CAR experience less liquidity in the post inclusion period. With respect to extent of speculative activity, the percentage shares delivered is less for companies with positive CAR in the pre inclusion period and the delivery trades are more for companies with positive CAR and with a continuation pattern in the post inclusion period. However, for companies with positive CAR and reversal pattern in the post inclusion period the delivery trades are lower.

## Conclusions

The price and volume event study results show that the STASM surveillance action helps in controlling the abnormal price movements and it is accompanied by fall in traded volumes on inclusion. There is no evidence of abnormal price movements or volume spikes in the post exclusion period. This implies that inclusion of stock in STASM helps controlling price volatility. Excess liquidity in the counters is also controlled by the surveillance actions, which is sustained in the post exclusion period. Based on the results of the study, it may be said that stocks that are included in STASM have characteristics similar to stocks whose prices are manipulated. STASM may have helped in curtailing abnormal price movements that are not supported by fundamentals. However, the restrictions imposed may have resulted in fall in liquidity. It is felt that, in an emerging market like India, restrictions imposed by surveillance initiative like STASM are important and may serve as warning bells to uninformed investors by highlighting trading actions that are suspicious, thereby contribute towards investor protection.

**Reference**

Baoling, S. U. N. (2021). An Empirical Analysis of Regulation on Open-Market Manipulation in China: An Effect-Based Approach. US-China Law Review, 18(3), 109-121.

Fama, E. F., Fisher, L., Jensen, M. C., & Roll, R.,1969, The adjustment of stock prices to new information. International economic review, 10(1), 1-21.

Huang, Y. C., & Cheng, Y. J. (2015). Stock manipulation and its effects: pump and dump versus stabilization. Review of Quantitative Finance and Accounting, 44(4), 791-815

Warner Brown, J., 1985, Using daily stock returns, the case of event studies. Journal of Financial Economics, 14, 3–31.

# Political Power-Sharing, Firm Entry, and Economic Growth: Evidence from Multiple Elected Representatives*

Harsha Dutta† Pulak Ghosh‡ Arkodipta Sarkar§ Nishant Vats¶

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**Abstract**

We examine the effect of political power-sharing on local economic activity by exploiting quasi-random variation in the number of politicians governing adjacent regions. We utilize haphazard overlap of electoral and administrative boundaries in India. This allows us to exploit geographic discontinuity across boundaries separating single and multiple-politician-governed regions, and within-region variation in the number of politicians. We find increasing the number of politicians governing an area leads to new firm creation, lower unemployment, and greater real economic activity. The effect is driven by greater state efficiency, lower regulatory bottlenecks, and reduced cronyism following increased checks and balances among non-aligned politicians.

**JEL Codes:** D73, M13, O43, P16

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†Harsha Dutta is at the Hong Kong University of Science and Technology. eMail:: sshdutta@connect.ust.hk

‡Pulak Ghosh is at Indian Institute of Management Bangalore. eMail: pulak.ghosh@iimb.ac.in

§Arkodipta Sarkar is at the Hong Kong University of Science and Technology. eMail: asarkar@ust.hk

¶Nishant Vats (corresponding author) is at the Booth School of Business, University of Chicago. Send correspondence to 5807 S Woodlawn Ave, Chicago, IL, USA. eMail: nvats@chicagobooth.edu

# 1 Introduction

Should political institutions concentrate power in more hands or a single hand? Political theorists have long debated the fundamental trade-off between the concentration of power among politicians and the checks and balances imposed on them in understanding the optimal design of political institutions. This paper examines a particular feature of the political-institutional design –multiple elected representatives or multiple politicians – and tests if increasing the number of politicians governing an area adds value. Specifically, we investigate the effect of the multiple politicians on firm entry and subsequent economic growth. Studying this relationship is imperative in understanding the implications of political institutions that foster power-sharing among politicians. Multiple politicians are typical across decentralized governance systems; for example, in the US, two senators govern each state, and coalition governments are becoming increasingly common across the globe. Moreover, answering this question can inform the broader literature on multiple managers that arise in a variety of situations, such as a firm or startup being managed by multiple managers or co-founders, the same entity being regulated by multiple regulatory authorities, doctoral students being advised by multiple chairs, courses being co-taught by multiple instructors, among others.

This paper presents microeconomic evidence on the link between power-sharing among politicians and economic activity in a setting that allows us to examine the effect of the presence of multiple elected representatives. Specifically, we study the role of these representatives in shaping the environment that facilitates firm entry and consequently fosters economic growth. New firm entry is an important determinant of aggregate productivity growth and local employment. Since new firm creation is a function of local economic and political conditions, this setting provides a natural setup for evaluating the effect of multiple politicians on local governance. Additionally, the heterogeneity in the reliance of new firms on governance allows us to identify the underlying mechanism.

Theoretically, the relationship between multiple politicians and economic growth is ambiguous. On the one hand, multiple politicians can hurt local economic conditions due to the presence of multiple grabbing hands, increasing the holdup problem, and due to the lack of collective action, because of coordination failure or free-rider problem. On the other hand, multiple politicians can improve local economic conditions by reducing the concentration of power and imposing checks and balances on each other (Bardhan (2002)), bringing different skills to the table as well as division of labor (Holmstrom (1978), Epstein and O'halloran (1999)) or reducing corruption (Rasmusen and Ramseyer (1994), Rose-Ackerman (1994)). Despite the theoretical ambiguity, the empirical evidence is limited, primarily due to issues of endogeneity associated with the emergence of political institutions that foster power-sharing among politicians, as discussed in Aghion, Alesina and Trebbi (2004).

The quasi-random variation in the distribution of the number of politicians and granular geo-referenced novel micro-data on firm entry allows us to use a geographic regression discontinuity (RD) to identify the effect of multiple politicians. Specifically, we compare units located close to the boundary separating split blocks from unsplit blocks.[1] Comparing units, villages hereafter, on either side of the boundary separating split and unsplit blocks after 2008, we find the number of new firms is 3% higher in villages just inside a split block relative to villages in unsplit blocks just outside the boundary. Similarly, the villages just inside a split block are associated with 7% higher nightlight intensity than villages in unsplit blocks just outside the boundary. Additionally, villages just inside a split block are associated with 5% higher employment and reduced demand for unemployment benefits, which is reflected in the lower application rates of the national employment guarantee scheme (NREGA). Furthermore, we document that the treatment effect increases monotonically with the number of politicians governing the split blocks.

We explore several dimensions of cross-sectional heterogeneity in industry and firm characteristics to evaluate the pathways underlying the higher entry of firms in blocks with multiple politicians. Our results suggest multiple politicians increase firm entry by reducing regulatory bottlenecks – manifested through the higher entry of firms in regulated industries. Moreover, we provide direct evidence showing the projects announced in split blocks take less time to receive regulatory approvals. This finding is further reflected in the higher entry of small firms, because regulatory or procedural bottlenecks often act as barriers to the entry of small firms.

Finally, we investigate if potential checks and balances drive multiple politicians to provide a better economic environment that facilitates firm entry. Our premise of checks and balances between multiple politicians will be highest if collusion between multiple politicians is difficult. We use two measures that can potentially affect the benefits of collusion or deviation – non-alignment in political parties and non-alignment in caste. Exploiting the differences in political parties and the caste of politicians in split blocks, we find greater firm-entry in blocks split across multiple politicians who are non-aligned either in political party or caste lineage. The results indicate the primary channel through which multiple politicians positively affect firm entry is by imposing checks and balances on each other.

# 2 Empirical Strategy

The empirical strategy hinges on comparing two administrative regions that are similar in all attributes but differ in the number of politicians at the helm of their administrative affairs. To do so, we follow two identification strategies. First, we employ a cross-sectional geographic regression discontinuity design by examining the differences in the outcome variable on either side of the boundary separating a split block and an unsplit block. Second, we employ a differences-in-

[1]The unit in our analysis refers to a village. We use the terms village and units interchangeably.

discontinuity design by exploiting the 2008 delimitation of electoral constituencies. The redrawing of electoral constituency boundaries resulted in converting some unsplit blocks into split blocks and vice versa. The natural experiment of delimitation allows us to examine changes in differences across the border between two blocks in cases where delimitation changes the number of politicians in a block while keeping them fixed in the contiguous block.

# 3 Results

**Spatial RDD** This section examines the effect of multiple politicians. Specifically, we compare the spatial difference in the propensity of firms to enter and the consequent impact on local economic activity measured through nightlight intensity in a split block compared with an unsplit block. We find that entry of new firms measured through the MCA data is 3% higher in villages just inside a split block than in villages in unsplit blocks just outside the boundary. Similarly, a split block experience 7% higher nightlight intensity than villages in unsplit blocks just outside the boundary. Next, we analyze the effect on employment. Using census data, we find 6% higher employment in villages just inside a split block than in villages in unsplit blocks just outside the boundary. Lastly, we document 5% lower applications for unemployment benefits filed under National Rural Employment Guarantee Scheme (NREGS), suggesting lower demand for unemployment benefits.

**Robustness** We conduct a battery of robustness tests to ensure our results are not driven by a particular econometric specification, specific sample or transformation of the dependent variable, differences across villages along the boundary and covariates, firm exit, spatial auto-correlation, and spurious correlation.

**Differences-in-Discontinuity Results** Next, we examine the effect of the exogenous change in the number of politicians governing a block, following the 2008 delimitation. We analyse the result in two ways: First, a block switching from being unsplit to split following the 2008 delimitation – the treatment group. The control group comprises of blocks that are always unsplit both before and after the delimitation and share a common boundary with the treatment group. The estimate indicates the transition of a block from being governed by a single politician to multiple politicians is associated with a 1.1% - 1.6% increase in the entry of new firms. Second, ssociated with a block switching from being split to unsplit following the 2008 delimitation – the treatment group. The control group comprises blocks that are always split among multiple politicians before and after the delimitation and share a common boundary with the treated group. The estimate of interest is negative and indicates a reduction in firm entry by 0.7% - 1.0% when a block switches from being governed by multiple politicians to a single politician.

# 4 Mechanism

Theoretically, multiple politicians can either reduce or increase economic growth. The results discussed provide robust evidence that multiple politicians increase firm entry and, consequently, economic growth. This section probes the underlying mechanism through which multiple politicians positively affect firm entry. We show the increase in the entry of firms is driven by reduction in regulatory impediments, reduction in cronyism, and overall improvement in the efficiency of the state in providing public good aiding the entry of new firms. We argue these improvements result from greater checks and balances imposed by the existence of multiple politicians.

**How Do Multiple Politicians Encourage Firm Entry?** We show multiple politicians, particularly from opposing political dispensation or from different castes, impose checks and balances on each other, manifesting as better conditions that foster firm entry. We investigate the mechanism of checks and balances by examining the private returns that the politicians make through the power of their public office. Bhavnani (2012) and Fisman, Schulz and Vig (2014) show a relatively high rate of growth in assets of the winning politician (winner's premium) reflects rent-seeking by the winner. Moreover, they argue the rent-seeking behavior of winners is likely to be greater when corruption is higher. Shleifer and Vishny (1993) show corruption can increase in the presence of multiple politicians if they act as independent monopolies. However, corruption can decrease when multiple politicians exert checks and balances on each other. Consequently, in the presence of multiple politicians, a politician's assets are less likely to grow higher than the runner-up when checks and balances are the dominant force.

# 5 Conclusion

Political institutions play a vital role in shaping the economy. Hence, understanding what type of political institutions are relatively better at fostering economic growth is of utmost importance. In this paper, we examine a particular feature of political-institutional design – multiple politicians governing an area. Our empirical investigation is motivated by the theoretical ambiguity surrounding the potential effect of multiple politicians. Multiple politicians can hurt the local economy due to issues of coordination, free-rider problem, common agency problems, and too many grabbing hands. Alternately, multiple politicians can improve the local economy by reducing the overall concentration of power, imposing checks and balances on each other, bringing different skills to the table, and the division of labor. We show that multiple politicians improve the local economy, evidenced by greater firm entry and economic growth.We find the results are driven by an increase in checks and balances in the presence of multiple politicians, as manifested by a higher impact when they belong to different political parties. The increased checks and balances among multiple politicians boost the local economy by improving state efficiency and reducing regulatory costs and

cronyism.

The results expand our understanding of a specific feature of the political-institutional design that is particularly relevant in understanding the effect of horizontal decentralization, common across several decentralized governance systems. Our results strengthen the faith in the conjecture that imposing checks and balances on agents with authority can result in better governance. Moreover, our results expand our understanding of the costs and benefits of multiple principals and a potential channel through which multiple principals can have a positive impact.

# References


**Aghion, Philippe, Alberto Alesina, and Francesco Trebbi.** 2004. "Endogenous political institutions." *The Quarterly Journal of Economics*, 119(2): 565–611.

**Bardhan, Pranab.** 2002. "Decentralization of governance and development." *Journal of Economic Perspectives*, 16(4): 185–205.

**Bhavnani, Rikhil R.** 2012. "Using asset disclosures to study politicians rents: An application to India." Vol. 22.

**Epstein, David, and Sharyn O'halloran.** 1999. *A transaction cost politics approach to policy making under separate powers.* Cambridge: Cambridge university press.

**Fisman, Raymond, Florian Schulz, and Vikrant Vig.** 2014. "The private returns to public office." *Journal of Political Economy*, 122(4): 806–862.

**Holmstrom, Bengt Robert.** 1978. *On Incentives and Control in Organizations.* Stanford University.

**Rasmusen, Eric, and J Mark Ramseyer.** 1994. "Cheap bribes and the corruption ban: A coordination game among rational legislators." *Public Choice*, 78(3-4): 305–327.

**Rose-Ackerman, Susan.** 1994. "Reducing bribery in the public sector. Corruption & Democracy: Political institutions, processes and corruption in transition states in East-Central Europe and in the former Soviet Union."

**Shleifer, Andrei, and Robert W Vishny.** 1993. "Corruption." *The Quarterly Journal of Economics*, 108(3): 599–617.

# Does the type of settlement matter?
# Evidence from Indian Derivatives Market.

Prachi Jain
Research Scholar
Indian Institute of Management Indore

## 1 Introduction

A derivative contract has two modes of settlement- physical delivery or cash settlement. Under a settlement through physical delivery, the trader with a short-position is obliged to deliver the underlying asset at a specified location. The mode of physical delivery opens conversation about the quality of asset, the location of the asset, the storage, transportation and the insurance costs. The addition of several contractual specifications makes the contract lose its tradability in the market, especially in case of commodities. Under the alternative mode of cash settlement, a cash transfer is conducted by squaring off the difference between the prevailing market price and the agreed exercise price. As per conventional wisdom, cash settlement system leaves little scope for market manipulation techniques such as – market cornering or market squeezes, which otherwise have been rampant under the physical delivery mode of settlement. The study illustrates the comparitive impact of the two settlement modes on the overall market welfare by analysing the case of India, where the Securities Exchange Board of India (SEBI) mandated a phased shift of all stock futures and options contracts from a cash settlement to a physical delivery system from April 2019 onwards. As per the mandate, phased transition would occur in two steps- 1) Stocks which were being cash settled shall be ranked in descending order based on daily market capitalization averaged for the month of December 2018; 2) Based on the ranking arrived above, the bottom 50 stocks shall move to physical settlement from April 2019 expiry, the next 50 stocks from the bottom shall move to physical settlement from July 2019 expiry, and the remaining stocks shall move to physical settlement from October 2019 expiry.

We measure the market welfare using three prominent constructs - volatility in the spot market, hedging efficiency of futures, and the price discovery in the futures market. We explain the plausible channels of impact of a physical mode of derivative settlements on the mentioned market welfare constructs as follows:

1. **Volatility in spot market:** A mandatory physical settlement of contracts, robs off the traders of the privilege of settling off their positions in the market by transferring cash on the expiry day. Therefore, the traders will have to roll-over their position ahead of expiry day, averting the lumping of roll-over positions on expiry day that leads to excess volatility.

At the same time, the need for owning/borrowing the stocks before indulging into a short position is likely to induce relatively higher activity and volatility in spot markets.

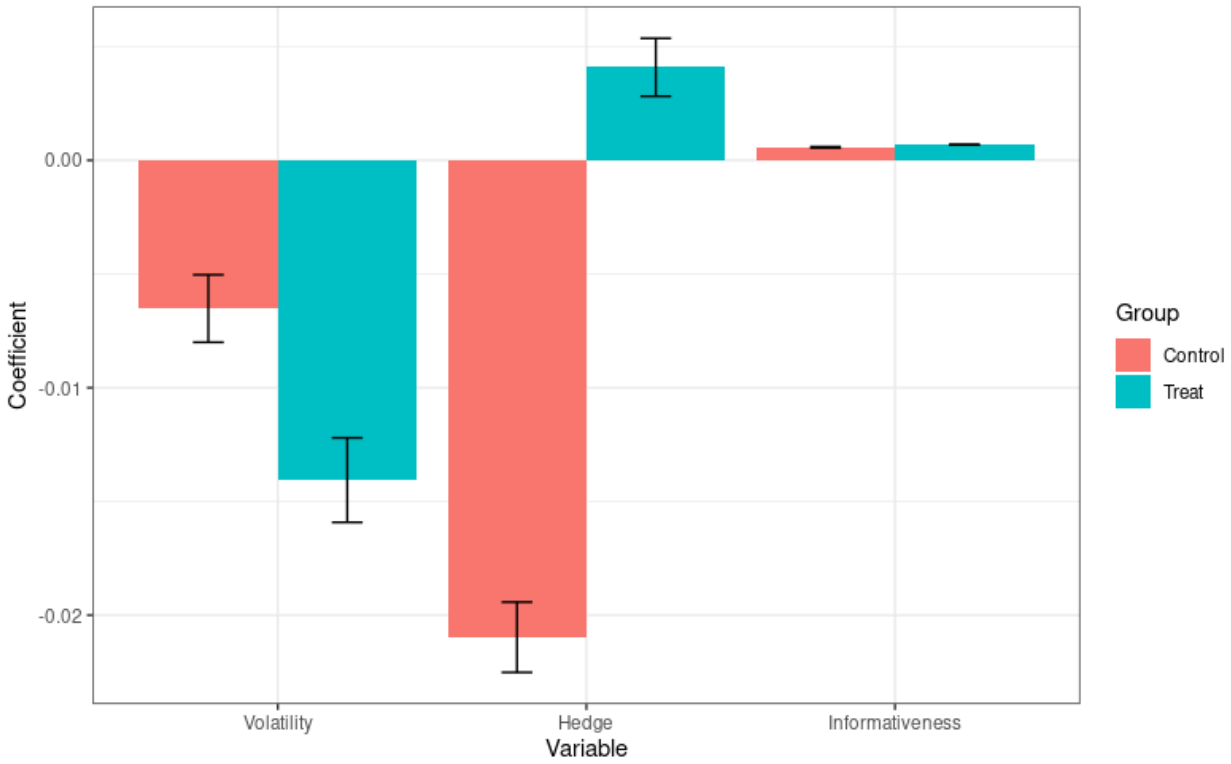
2. **Hedging Efficiency of futures:** With physical delivery of contracts upon expiry, a call option writer is redeemed from purchasing the contracts in spot market to deliver them to the buyer. Instead, he would transfer the shares he received at an agreed price to the respective option buyers, hence mitigating his hedging risk exposure.
   However, physical deliveries may reduce short-selling as short-sellers would now be required to borrow stocks under the Securities Lending and Borrowing (SLB) mechanism which remains a shallow space in India. With higher cost of borrowing under the SLB mechanism, cost of hedging is also raised, lowering the efficiency of hedging in the market.

3. **Price Discovery of futures:** The distinction between futures and spot markets is removed upon introduction of physical settlement in the spot markets. This convergence in prices may enhance the information dissemination between spot and futures.
   On the other hand, a consequent shift in traded volumes from equity spot and futures market to cash-settled equity-indices may dry up the stock futures and options market. A drop in volume may exacerbate the bid-ask spread and adversely impact the price-discovery mechanism.

## 2 Findings

We find that upon the adoption of physical settlement of derivatives in April 2019, the stock that experienced the intervention (treated) experienced a decline in volatility, and the decline in volatility for the treated group is significantly lower than the change in volatility for the untreated (control) group stocks. The same has been presented in Fig. 1. One plausible explanation for the observed decline in volatility is the reduction in speculation that SEBI targeted for. When stocks cannot be settled by squaring-off cash-differences, traders are likely to refrain from excess speculation wherein an over-ambitious trade-position could multiply their risk several times. Therefore, traders have to be wary while trading in the derivatives segment, as they may end up paying the full contract value besides the margin money. As a result, traders are cautioned to roll-over their positions ahead of the expiry week when settlement can only be done through physical delivery. This mitigates the lumping of roll-over positions on expiry day curbing volatility in the market. At the same time, the hedge ratio determined from DCC-GARCH model demonstrates a significant increase in the hedging-efficiency of the futures contracts. The results therefore lead us to believe that hedging ratio of futures contracts increased significantly upon introduction of physical settlement. We also witness a significant rise in the informativeness of the futures contracts in the market. Even though investor's attention is likely to shift towards the cash settled indices, the significant rise in the convergence of the spot and futures market reflects as a rise in informativeness of futures contracts.

Figure 1: Impact on market welfare upon adoption of physical settlement of derivatives




The plots provide a visual representation of the difference in the changes of outcome variables for treated group and control group. The bars represent $\alpha$ (estimated impact on control group stocks) and $\alpha + \beta$(estimated impact on treated group of stocks). Error bars represent 95% confidence intervals using robust standard errors.

# 3 Conclusion

The study investigates if the mode of settlement of futures contract - cash or physical-delivery has any significant influence on the volatility in the spot market, the hedging efficiency of futures, and the price-discovery function of futures contracts. With a treatment sample of 46 stocks that were moved to physical delivery system by SEBI from April, 2019 expiry and a control group of 45 stocks that were mandated to switch to a physical settlement mode from July, 2019. The analysis takes onto a Difference in Difference approach to look for significant deviations in the market upon the said intervention by SEBI. The empirical evidence suggests a significant decline in spot-market volatility. At the same time, hedging ratio is recorded to rise accompanied with improvement in price discovery efficiency. However, the effect of intervention on the market is likely to fade away with time as markets adjust to the newness.

# What Happens When Ratings Shopping is Visible? Evidence from Unaccepted Ratings Disclosure*

Sanjay Kallapur† Hariom Manchiraju‡ Abdul Khizer§
Rajesh Vijayaraghavan¶

## 1 Introduction

Credit rating agencies (CRAs) play an important role in the functioning of debt markets around the world. However, on several instances CRAs have been criticized for failing to sufficiently forewarn about the impending defaults (e.g., financial crisis of 2008-09), thereby raising questions on the quality of these credit ratings. A long standing discussion in this thought is their issuer-pays business model, and the potential conflicts of interest it opens. CRAs are paid by the firms issuing the securities, which they rate. And the firms directly benefit when they receive high ratings. In further understanding this conflict, regulators and researchers, identify ratings shopping as an important factor affecting the ability of CRAs to provide reliable credit ratings.

Rating shopping refers to the phenomenon where the issuer receives preliminary opinions from multiple CRAs, but purchase and report only the most favorable rating(s), rejecting the others. Therefore, publicly observed ratings reflect a selection bias induced by rating shopping, and often

*Sanjay Kallapur, Abdul Khizer, Hariom Manchiraju are at the Indian School of Business. Rajesh Vijayaraghavan is at the University of British Columbia, Sauder School of Business. The authors acknowledge the financial support of the NSE – NYU Stern Initiative on the Study of Indian Financial Markets for this research work. Rajesh Vijayaraghavan also acknowledges financial support from the Social Sciences and Humanities Research Council of Canada.

†Email:sanjay_kallapur@isb.edu
‡Email:hariom_manchiraju@isb.edu
§Email:abdul_khizer@isb.edu
¶Email:rajesh.vijayaraghavan@sauder.ubc.ca

likely to be inflated on average. The ability of issuers to shop around for favorable ratings can also create pressure on CRAs to cater to the demands from clients, and provide them with higher ratings, so as to not miss out on business opportunities, when an issuer goes to a different CRA.

Regulators have long considered the above concerns while regulating CRAs; and attempted to increase transparency of the rating process, and limit conflicts of interest. On one end, an inherent challenge to deter rating shopping is its unobservable nature. But on the other end, any regulation could possibly alter the behavior of firms issuing the securities, and that of the CRAs, resulting in unintended consequences. Therefore, research on understanding regulation of rating process has important implications from regulatory, practitioner, and academic stand point.

## 2 Research Question

In this paper, we examine the implications when rating shopping becomes observable. To be specific, our research question studies the changes in the issuer, and CRA behavior in an enhanced disclosure regime where investors have information about both the favorable and unfavorable ratings assigned to an issuer. We use a recently enacted regulation in India as a natural experiment to answer our research question. In November 2016, in an attempt to limit conflicts of interest in CRAs in India, the Securities Exchange Board of India (SEBI), enacted a regulation (Circular 2016/119) that requires CRAs to provide details of all ratings that were provided by them, including the ratings rejected and hence not disclosed by the issuers. These details include the name of the issuer, name/type of instrument, size of the issue, rating and outlook assigned, etc., and are available on the website of CRAs. In this paper, we examine whether such enhanced disclosure requirements about rejected ratings by issuers can limit ratings shopping, and thereby reduce ratings inflation.

# 3 Our Study

To set the discussion, our study first identifies two forms of possible rating shopping behaviour by issuing firms. First, the one identified in the prior section, and focus of prior academic research, is the possibility where issuers seek rating from multiple CRAs, and then strategically decide whether to report it or not. We refer this as strategic reporting. Second, issuers may rely on informal channels, or prior working relationships, to directly select CRAs, in anticipation that they will give them a better rating. We call this shopping behaviour as strategic selection of CRAs.

We then build our analysis on the conjecture that following the SEBI disclosure regulation, rating shopping will be a pointless exercise for the issuers, given that all ratings become visible. It is also likely to relieve the pressure on CRAs to cater. Together, it would decrease ratings shopping in the first form through strategic reporting; thereby improving the overall quality of credit ratings. However, issuing firms could simply adjust their choice of CRAs directly to the ones they know would give them a higher rating, and switch to the second form of rating shopping through strategic selection. For this reason, the pressure on CRAs to cater to inflated ratings is not likely to reduce. Hence enhanced disclosures are unlikely to have any impact on the overall quality of credit ratings.

Our sample to answer the research question comprises of 57,478 unique ratings relating to 12,094 Indian firms from 2014-2019. We consider three years before (pre-period) and after (post-period) the additional SEBI disclosure requirements went into effect. We measure the first form of rating shopping, by strategic reporting, and identify firms to have engaged in rating shopping if it obtains rating from a single CRA rather than multiple CRAs. To measure the second form of rating shopping, we identify firms to have engaged in rating shopping if it obtains rating from smaller rating agencies as opposed to larger, and more reputed rating agencies. The intuition is that smaller CRAs are more likely to pick revenue growth, and appease issuing firms' demands for favorable ratings.

Three measures of ratings inflation are used in the study: 1) by considering the level of ratings, 2) chances of a firm getting investment grade rating. To measure the egregious cases, 3) we

identify based on Type 1 error, reflecting scenarios where rating agencies issue favorable ratings to subsequently defaulting issuers.

# 4 Results

We first show frequency differences between the pre-period and post-period of the enhanced disclosure regulation. We find that in the pre-period, 85% of all instruments were rated by only one CRA. However, in the post-period 81% of all instruments were rated by single CRA. These statistics show that rating shopping, by strategically reporting ratings, is an extremely widespread phenomenon, and that enhanced disclosure requirement under SEBI Circular 2016/119 leads to a decline in this form of rating shopping. We then find that while 17% of all instruments are rated by smaller CRAs in the pre-period, there is an increase in this frequency to 27% in the post-period. Thus, we find that, while the enhanced rating disclosure reduces rating shopping, through issuers strategically reporting ratings, it increases the rating shopping behavior, in issuers strategically selecting a CRA.

We then perform econometric analysis accounting for other variables like firm level effects, macroeconomic control variables such as GDP growth, risk free rate, and the aggregate defaults to control for overall time trends. In certain econometric models, we also account for rating agency effects. We present a summary of our results in our discussion below. Further discussions are in the working paper version. First, we find that that there is a 5.1% decline in the average tendency of firms to employ a single CRA in the post enhanced disclosure regime. Consistent with the frequency differences discussed above, this suggests a reduction in the rating shopping behavior, in the first form through strategic reporting by firms, in the post-regulation period. We then find that there is a 11.1% increase in the average likelihood of a firm to get ratings from a smaller CRA in the post-regulation period. Consistent with our discussion in the previous section, this finding indicates an increase in firms strategically selecting CRAs, by switching to smaller CRAs for their possible leniency in credit rating standards and incentive to gain market share.

Overall, we find that while the enhanced disclosure requirement for unaccepted ratings leads to a decline in rating shopping in the first form, but it leads to an increase in the second form of shopping behavior in firms strategically selecting a CRA. These results seem to suggest that by engaging more with smaller CRAs, issuing firms are able comply with the new disclosure requirements, and yet achieve their objective of obtaining favorable ratings.

Next, we study the impact of enhanced ratings disclosure requirements on the extent of ratings inflation using our three measures: ratings level, likelihood of investment grade, and Type 1 error. We find that in the post-disclosure regulation period, the average ratings assigned to firms is approximately 0.66 notches higher. If firms at the lower end of the rating spectrum (i.e., non-investment grade) obtain investment grade rating due to rating shopping, their investment ability increases. Hence, rating shopping is most likely to take place around important thresholds such as investment grade ratings. Consistently, we find that there is a 9.13% increase in propensity of a firm to get an investment grade rating in the post enhanced ratings disclosure regulation period. We also find the incidence of Type 1 error does not vary significantly between pre and post regulation period. Overall, these results indicate an increase in ratings inflation to certain extent in following the enhanced ratings disclosure regulation.

We then examine whether certain firm, or certain CRA characteristics, are associated with higher ratings inflation, in the post period relative to the pre period of the regulation. First, we consider large firms, as these are the firms who have the ability to influence CRAs rating decisions and are known to get higher ratings. CRAs stand to generate more revenue from large firms, relative to small firms, by providing rating as well as non-rating services. In our empirical analysis, we find that large firms, relative to small firms, receive higher ratings by 0.11 notches, have 3.1% greater propensity to get an investment grade rating, and have increased frequency of Type 1 error in the post regulation period, compared to the pre-regulation period. Overall, these results indicate that larger firms get more favorable ratings in the post regulation period possibly because of CRAs catering such demands in expectation of future revenues.

Second, we argue that compared to larger and more established CRAs, smaller CRAs are under greater pressure to increase their revenues. We also posit that larger CRAs have greater need to preserve their reputation under greater regulatory scrutiny. Hence, compared to smaller CRAs, larger CRAs are less likely to cater. Based on these arguments we expect greater inflation in the ratings provided by the smaller CRAs in the post regulation period. We classify the following three rating agencies – India Rating, Brickwork, and Acuite as small CRAs. The large CRAs, hence, are CRISIL, CARE, and ICRA. We find that ratings provided by smaller CRAs in the post regulation period are 0.36 notches higher than the ratings provided by larger CRAs. The probability of getting an investment grade rating in the post regulation period is also higher by 1.7% if such rating is provided by smaller CRA. The frequency of Type 1 error increases by 0.5% in the post regulation period for ratings provided by smaller CRAs, while it does not change for the ratings provided by larger CRAs. Overall, these findings are consistent with our expectations that smaller CRAs are more likely to cater to the demand of favorable ratings by issuing firms.

Finally, we consider whether the rating inflation varies in the post regulation period based on the debt instrument being rated. We classify debt instruments issued by firms as whether they are bank financed vs public debt. Our assumption is that banks are more likely to tolerate (or even encourage) ratings inflation as higher ratings enables them to classify the loan as less risky and thereby improve capital adequacy calculations. We empirically test, and find that ratings provided for non-bank debt instruments in the post regulation period are 0.15 notches lower than the ratings provided for bank debt instruments. The probability of getting an investment grade rating for non-bank debt instruments in the post regulation period is also lower by 2.5%. Further, the frequency of Type 1 error increases by 2.4% in the post regulation period for ratings relating to non-bank debt instruments.

Overall, these results are consistent with our expectations that enhanced ratings disclosure requirements are going to be useful for investors as they can see through the shopping efforts of CRAs and can price the bonds accordingly. As a result, rating shopping is less attractive for issuing

firms in such situations. However, when the end user of the ratings is a bank who has perverse incentives to prefer inflated ratings, enhanced ratings disclosure requirements are unlikely to keep rating shopping and rating inflation under check.

# 5 Conclusion

Credit rating agencies are important gatekeepers that ensure proper functioning of the debt markets. However, the CRAs business model has been subject of longstanding scrutiny. Much of the concerns are from that the issuer-pay model, where the CRA main revenue in fee income is from the companies that they rate. This conflict creates pressure on the CRAs to provide biased ratings for increased fees, and allows issuers to shop for inflated ratings. But the extent of rating shopping by issuers, and the CRAs ability to cater is unobservable and therefore difficult to empirically determine.

In this paper, we exploit a setting in India, where SEBI enhanced disclosure requirements for CRAs to provide details of ratings that were issued by them, but were rejected by issuers, and hence not disclosed by the issuers. We examine whether such disclosure regulation has an effect on ratings quality, by limiting ratings shopping and thereby reducing ratings inflation.

We provide evidence that rating shopping is a widespread phenomenon in the Indian setting, and that the enhanced disclosure requirements leads to a decline in the rating shopping, in the first form through strategic reporting of ratings. We also find that in the post-regulation period, issuing firms are more likely to approach a smaller CRA, as against a larger CRA; with the intention that smaller CRAs are more likely to cater to the demands of the issuing firms demands for an inflated rating. We interpret this result as an unintended consequence, with an increase in rating shopping in the broader form, where firms strategically selecting CRAs in the post-regulation period. We also find an increase in the incidence of an issuing instrument receiving an investment grade, with the results being stronger to the subsample of larger issuing firms, which suggests that the potential for future business induces CRAs to issue favorable ratings to larger issuers. We finally consider the predictive ability of ratings and document an increase in the incidence of Type 1 error in the

post-regulation period, with the results stronger among larger issuing firms. We find similar results when comparing smaller CRAs relative to large CRAs, and greater ratings inflation in the ratings provided by the smaller CRAs in the post regulation period.

We argue that this research comes at a critical juncture when policy makers across the globe are considering regulations such as enhanced disclosures to avoid another financial crisis. Consequently, our results should be of interest to academics, regulators, and market participants. Overall, we document that a legislation demanding enhanced disclosures may not be the panacea to resolve conflict of interest issues in CRAs.

White Paper: NSE-NYU Stern Initiative on the Study of Indian Financial Markets 2021

# Bank Deposit Franchise, Interest Rate Risk, and Default Risk: Evidence from India *

Nirupama Kulkarni † Akshat Singh‡

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## A. Summary

In this paper, we show that the deposit franchise of banks significantly influences their lending behaviour, and correspondingly, risk management. Deposit franchise allows banks to pay deposit rates that are low and insensitive to market interest rates. However, maintaining this franchise requires high fixed costs. In order to hedge against interest rate risk arising from these fixed costs, banks with strong deposit franchises seek to reduce sensitivity of their interest income to market rates by holding longer-term fixed-rate assets. We provide evidence for this theory from India, and show that this behaviour can help partially rationalise India's infrastructure credit boom of the 2000s. During this period, banks with stronger deposit franchise switched from long-term government securities to long-term fixed rate loans, particularly in the risky infrastructure sector. We highlight that rising bond yields and associated mark to market losses on bond holdings may have exacerbated the switch towards infrastructure sector, eventually resulting in high non-performing loans. Overall, while maturity transformation allows banks to shield their net interest margins from interest rate risk, we propose that market incompleteness in developing economies may lead to a tradeoff between stabilising net interest margin and default risk.

## B. Indian Context

**Infrastructure credit boom:** Share of bank credit to the infrastructure sector in India doubled within a span of four years from 2004 to 2008. We highlight the stark change in the average asset portfolio of Indian banks during this period. At the outset of this period, Indian banks were characterised by extremely high holdings of long term government securities, among the highest in the world. In 2004, as the Fed raised rates for the first time since May 2000, and oil prices rose sharply due to a Hurricane that hit the United States and neighbouring countries, there was a sudden and significant rise in Indian government bond yields. On account of this rise in long term yields and corresponding fall in prices, banks suffered substantial mark-to-market losses, and rapidly substituted away from long-term securities towards long-term loans. From 2004 to 2008, the average ratio of long term securities to bank assets declined drastically from about 0.30 to 0.17, while the ratio of infrastructure loans to assets doubled from 0.035 to close to 0.07.

**Institutional details:** In principle, both public and private sector banks are insured by the Deposit Insurance and Credit Guarantee Corporation (DICGC). However, as of 2007, this deposit insurance coverage was limited to only Rs.100,000 (approximately $2000) per depositor. Moreover, as highlighted in

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†CAFRAL, Research Department, Reserve Bank of India Main Building, Fort, Mumbai 400 001, e-mail:nirupama.kulkarni@gmail.com.

‡Department of Economics, University of Oxford, UK, e-mail:akshat.singh@economics.ox.ac.uk

Iyer and Puri (2012), the processing of deposit insurance claims is associated with significant uncertainty and delay which reduces their effectiveness. In this context, explicit government guarantees endowed to public sector banks by virtue of The Banking Regulations Act (1949), as highlighted by **?**, which guarantees all obligations of public sector banks in the event of their failure, assume much greater importance.

This sovereign backing, however, is not free of cost. Public sector banks are subject to the same operational constraints and rigidities as the rest of government enterprises in India. In order to satisfy the governments financial inclusion goals, public sector banks operate a wider network of branches across urban as well as rural regions. This means that they significantly lag behind private and foreign sector banks in terms of average deposits/credit per branch (Chatterjee, 2006). Moreover, PSB employee productivity is also significantly lower as compared to private sector banks because of a difference in the employment practices across the two sets of institutions. A report by Financial Express (Financial Express, 2019) highlights this stark difference: the officer to clerk ratio for private banks was 16:1 compared to the 1.25:1 ratio for public sector banks. To the extent that banking is an increasingly specialised service, hurdles faced by government owned institutions in changing their hiring practices contribute significantly to the cost inefficiencies of the PSBs relative to PVBs. In this paper, we treat these costs as the fixed costs of sovereign guarantees.

While sovereign guarantees are the source of the strong deposit franchise of public sector banks, private sector banks have to invest in building deposit market concentration in order to strengthen theirs. In this sense, the functioning of private sector banks corresponds directly to the setup in Drechsler et al. (2021).

## C. Data

We use annual branch and bank level data from the Reserve Bank of India to compute our bank-level HHI measure, for our bank-district level regressions, for data on sector and maturity wise bank lending, and for our subsequent analysis on branch level non-performing loans. Data on the Repo rate is also obtained from the Reserve bank of India website. While bank level data is publicly available, branch-level data is from Basic Statistical Returns (BSR) and provided by the Reserve Bank of India. We use quarterly financial data from CMIE Prowess in order to compute the sensitivity of bank level interest expense, interest income, and return on assets to changes in the RBI Repo rate and to derive the aggregate time series for average net interest margin and return on assets.

## D. Research methodology

**Interest rate risk hedging:** In the preliminary baseline analysis, we follow the approach in Drechsler et al. (2021) to test whether banks hedge against market interest rates by matching sensitivities of their interest income and interest expense. We use a two-stage panel setup: in the first stage we compute the interest expense sensitivity to changes in market interest rate (Repo rate) by regressing the change in interest expense divided by assets on contemporaneous and lagged changes in the Repo rate. The interest expense beta, which we use as a measure of bank deposit franchise, is obtained as the cumulative value of the coefficients of Repo rate changes in the first stage. In the second stage, we regress the change in interest income ratio on the predicted changes in interest expense ratio obtained from the first stage to analyse the degree to which banks match their interest expenses to their income.

**Sources of deposit franchise:** In order to investigate the sources of deposit franchise of banks in India, we run a modified version of the first stage panel regression described above, with interest expense rate regressed on contemporaneous and lagged changes in Repo rate interacted with the examined source such as bank HHI or state ownership. We further substantiate this evidence using scatter plots of interest expense betas plotted against bank HHI separately for private and state owned banks.

**Deposit franchise and lending behaviour of banks:** We hypothesise that banks with strong deposit

franchise had high exposure to long term fixed rate securities at the outset of the boom period in consideration, which they then substituted for long term fixed rate loans in infrastructure during the boom. Using the regression specifications described above, we study whether banks' exposure to long term fixed rate securities, as measured by the investment fluctuation reserve ratio, is related to their deposit franchise. In order to then examine the substitution of assets from long term securities to infrastructure loans, we employ a triple difference specification using ex-ante heterogeneity across banks in exposure to long-term fixed rate securities in 2004 to study the relevance of deposit franchise for district level bank lending behaviour during the period after 2004. As a robustness test, we also run the same regression specification utilising heterogeneity in interest expense beta, measured using data up to 2004, across the cross section of banks as a more direct test of the relevance of banks liability structure for their lending behaviour.

**Accounting for demand variations:** Importantly, in the triple difference regressions employed, we control for district-time fixed effects in order to account for important demand side variations during this period. However, it is possible that demand variations were limited to a subset of the banks, in which case district-time fixed effects do not conclusively provide evidence of a supply side effect. We therefore estimate state level lending rates for each bank and sector, and use these as the dependent variable in the triple difference regression specification. If demand played an important role in driving the lending behaviour observed during this period, one would expect bank lending rates to vary accordingly.

## E. Findings

We present four main sets of findings.

- First, we show that even in the face of a volatile central bank policy rate (RBI Repo rate), banks managed to maintain stable net interest margins. This appears to be the result of banks matching the sensitivity of their interest expenses and interest income to the RBI Repo rate.
- Second, we hypothesise and provide evidence for two distinct channels of deposit franchise for private and public sector banks: deposit market concentration of private sector banks and the government guarantees of state-owned banks allow them to maintain stable interest expense through changing Repo rate environments. We find a significant negative relationship between deposit market concentration and interest expense sensitivity to Repo rate for private sector banks. Public sector banks, on the other hand, show lower interest expense sensitivity than private banks in general, and unlike the private sector banks, this measure is not linked to their deposit market concentration. We interpret this finding as evidence that public sector banks derive their deposit franchise from the explicit sovereign guarantee, and thus deposit market concentration is of less relevance to these set of banks.
- Third, an immediate consequence of the matching is that banks with strong deposit franchise, whose interest expenses are low and insensitive to RBI Repo rate, tend to engage in substantial maturity transformation. We find evidence for this: banks with low sensitivity of interest expenses to market rates tend to hold significantly more long-term fixed rate securities, which are primarily government bonds in the Indian context, and long-term fixed rate loans such as infrastructure, as compared to banks with higher sensitivity of interest expenses to market rates.
- Fourth, we document that with the sudden rise in government bond yields starting in 2004, banks with stronger deposit franchises shift away from long-term investments to the default risk prone infrastructure sector. Correspondingly, we also find that ex-post, banks with lower sensitivity of interest expense to Repo rate have higher non-performing loans.

### F. Conclusion and Policy Relevance

In this paper, we examine the role of deposit franchise in banks' lending behaviour in India. The key message is that while maturity transformation may allow banks with substantial fixed operating costs to hedge against interest rate risk, it may expose them to higher default risk due to the scarcity of safe long-term fixed-rate lending avenues in developing economies such as India. Co-existence of state owned banks and private banks in India also allows an analysis of how state ownership in banking determines their deposit franchise. While state ownership provides banks with stable and cheap deposits due to explicit government guarantees, it may affect their lending behaviour through higher fixed operating costs, which commonly arise due to employment and financial inclusion objectives of the government imposed upon banks. In the absence of diverse long-term fixed rate lending opportunities needed to balance the significant fixed operating costs, banks may be inclined to undertake excessive exposure to the few available sectors such as infrastructure as in the case of India, leading to financial stability risks as observed in the infrastructure boom in India.

## References


Chatterjee, Goutam, 2006, Is Inefficiency of Banks in India a Cause for Concern? Evidence from the Post-reforms Era, *Journal of Emerging Market Finance* 5, 151–182.

Drechsler, Itamar, Alexi Savov, and Philipp Schnabl, 2021, Banking on Deposits: Maturity Transformation Without Interest Rate Risk, *Journal of Finance*.

Financial Express, 2019, Indian Banks have more Officers than Clerks; How the Situation Changed in just 15 years.

Iyer, Rajkamal, and Manju Puri, 2012, Understanding Bank Runs: The Importance of Depositor-bank Relationships and Networks, *The American Economic Review* 102, 1414–45.