Endogenous Market Development for Government Securities in Lower-Income Economies

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Tadashi Endo
Ph.D. Student
Graduate School of International Development
Nagoya University
Nagoya, Japan

Permanent Address
2-2-6, Mukoudai-cho
Nishi-Tokyo, Tokyo 188-0013
Japan

Email Addresses:
endotck@msn.com
endo.tadashi@g.mobox.nagoya-u.ac.jp

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Abstract

Many lower-income economies have difficulty developing government securities markets (GSMs). A "Two-Dimensional Policy Framework for GSM Development" offers a solution to improve upon the twenty-year-old World Bank/IMF's conventional policy framework. It differentiates GSMs by their development phases and presents endogenously phase-coherent policy sets. This research found that the endogenous variables explained 40 percent of trading volume growth in the early phase of India's GSM development and that utilities played a dominant role in increasing trade volumes in the early-phase market. The framework is worth test-applying to GSM development in lower-income economies.

Keywords: Government security; Market development; Low-income economy; Phase-differentiation; Endogenous variable; Utility

JEL classification: H63, O16, O21, and P43

1 Introduction

The government securities market (GSM) is a core economic infrastructure for modern economic management. Hence, the international development community (IDC), including the World Bank and IMF, established a comprehensive policy framework for GSM development in the early 2000s (the conventional policy framework−CPF) and undertook GSM development initiatives for more than two decades. However, the results are disappointing for lower-income economies (LIEs).[1] The secondary markets of most LIEs remain illiquid or considerably low liquid. (Endo, 2020) Nonetheless, no efforts have so far been made to review the CPF.

Hence, this research questions if there can be any policy sets for GSM development in LIEs that is necessary, implementable, and low-cost in a GSM's development phase and if there can be any policy framework to identify and formulate policy sets so that they may fit different development phases. These questions aim at finding a new way for the GSM in an LIE to facilitate and reinforce its macroeconomic and social achievements. In answer to these questions, I propose a "Two-Dimensional Policy Framework for GSM Development" (TDPF) (Table 1 and Figure 1) to enable the GSM policymaker to

[1] This study defines the World-Bank-defined low-income economies (LIEs) and many lower-middle income economies (LMEs) as "lower-income economies" unless otherwise specified. The World Bank defines low-income economies and lower-middle-income economies as those with a GNI per capita of $1,025 or less in 2018 and those with a GNI per capita between $1,026 and $3,995, respectively. (https://datahelpdesk.worldbank.org/knowledgebase/articles/906519-world-bank-country-and-lending-groups) "Emerging economies" in common parlance include not only "lower-income economies" but also higher-income economies that are not included in "advanced economies."

focus on endogenous GSM development). In this study, I test the TDPF for its real-world applicability with the Indian GSM's development path.

Endogenous market development is a way for the GSM policymaker to develop its GSM by actively working on endogenous policy variables. The TDPF is a policy tool for endogenous market development. This alternative framework is phase-differentiated so that facilities policymakers may work on the effective endogenous policy variables. The TDPF divides emerging GSMs into four groups by market development phases (phase-differentiation) and organizes CPF-policies[2] by market components to form a two-dimensional matrix table. The TDPF's phase- and local-fitness helps policymakers and practitioners identify and bundle GSM policies coherently, align deviated GSM policies timely with the rest of phase-coherent policy sets, or adjust an extant policy set without delay to a new economic or social environment.

The GSM policymaker's work on endogenous policy variables through the TDPF would be significantly practical, though not perfect, for GSM development. The GSM policymaker needs to manage endogenous policies systematically to ride on favorable environments for successful GSM development. To put it another way, the CPF-policies primarily address endogenous market variables. However, this fact has not been well recognized, and the policies have been left unorganized to meet individual GSMs needs.

In contrast, the CPF was derived primarily from gap analyses between advanced markets and emerging markets. Policy assessors typically compare their target emerging markets with "best practices" or "global standards" to identify gaps as impediments to market development. The gaps tend to be too substantial for LIEs. Nonetheless, they advise their client governments to fulfill or narrow those gaps. Advised governments usually attempt to implement the advice but end up implementing it only halfway. Their GSMs remain illiquid or low-illiquid.

The CPF implicitly conflated GSMs that were in different development phases. As such, inadvertent mismatches between adopted policies and LIE realities have often misled GSM development in LIEs. The blind reliance on a PD system is an example of those mismatches. Many LIEs have PD systems in place, but the systems are barely functioning (Endo, 2020). The phase-differentiated and phase-coherent TDPF would mitigate this kind of mismatch risk.

Testing the TDPF for its practicality can be ex-ante and ex-post. This study assumes that building credibility in the TDPF by ex-post testing with a successful case would be essential to let CPF-trapped LIEs and CPF-obsessed practitioners buy in TDPF-based programs. This is because ex-ante testing of the policy framework is its test application over at least several years and requires cooperation from the governments and stakeholders of tested GSMs. Most GSMs in LIEs have been CPF-trapped and unsuccessful in GSM development (Endo, 2020). By contrast, the Indian GSM is a rare successful LIE case and suitable for ex-post testing of the TDPF.

[2] Policies formulated, advised and implemented under various CPF programs. Most of them are found in World Bank and IMF (2001), World Bank (2007a, 2007b) and the World Bank/IMF's financial sector program documents, such as Financial Sector Assessment Program (FSAP) reports.

India showcases the effectiveness of phase-fit and locally-fit policies in its early GSM development phases.[3] The introduction of an innovative market infrastructure and practical market microstructure (collectively "market structure") in the early 2000s accentuated the effectiveness of phase-fit and locally-fit market development. The new market structure achieved the "transparency and ease" of trading. India built an integrated market structure electronically linked from order display to settlement with local technology to meet local needs. Before the country began a series of GSM reform initiatives in 2001 (the GSM Reform), the Indian GSM was more like a negotiated market (dealers club market) than an OTC market, though it had primary dealers (PDs). In a negotiated market, a small number of dealers traded over a communication device, such as the phone, for themselves or their customers,[4] though it is locally called an "OTC market." The Reserve Bank of India (RBI) practically refrained from adopting a quote-driven market-making PD system, which the IDC typically recommends to emerging GSMs. First, the RBI developed a screen-based order-driven trading platform or the Negotiated Dealing System-Order Matching (NDS-OM) in 2005 with local IT technology. Second, the central bank imposed a continuous two-way firm quote (market-making) obligation for order-driven trading on PDs but has left the two-parameter (the spread and volume) obligation not strictly enforced.

Earlier, the RBI organized state-owned financial institutions and private banks to set up the Clearing Corporation of India (CCIL) in 2001, built the Negotiated Dealing System (NDS) in 2002, and assigned its operation to the CCIL (RBI, 2013). The NDS, equipped with a central counterparty (CCP) function, was designed to automate government securities trades' clearing and settlement. The CCIL linked the NDS-OM to the NDS to achieve straight-through processing (STP). These innovative policies and sophisticated market structure enabled the GSM to increase turnover until 2015 (Figure 2).

Thus, the South Asian country caught the momentum of its increasingly favorable macroeconomic, fiscal, and monetary settings for GSM development with phase-fit policy sets. The country launched an economic transformation from a socialistic regime to a market-based one in 1991. The factors exogenous to the market became increasingly favorable for India's GSM development by the early 2000s. Then, the country's GSM policymakers did not miss out on those improvements of exogenous factors. Its GDP growth sustained between 5.24 percent and 8.49 percent (except for 3.09 percent in 2008), with an average of 7.09 percent, from 2003 to 2018. The national consensus for fiscal discipline resulted in the Fiscal Responsibility and Budget Management Act of 2003. The country's public debt[5] to GDP peaked off at 84.2 percent in 2003 and stayed between 66.0 percent and 68.8 percent from 2010 to 2018. Since the GSM Reform started in 2001, the inflation rate[6] had been reasonably low before it

[3] For the scarcity of GSM development success among lower-income economies (Endo, 2020).
[4] A negotiated market (dealers' club market) is a small decentralized market. Dealers usually quote prices upon request rather than a priori. They do not make a market. If they quote a priori, the quotes are more occasional than continuous and smore indicative than firm. Dealers agree on prices and other trade terms through negotiation for each deal, subject to market conventions or regulations. Dealers rely on the network of fellow dealers to source information and tradable securities. It may be viewed as an OTC market in the sense that it has no physically centralized marketplace or electronically connected trading platform. (Table 1)
[5] General government gross debt as defined by IMF.
[6] Average consumer prices.

climbed from 6.7 percent in 2006 to 12.3 percent in 2009. Subsequently, the rate decelerated below 5 percent since 2015 and below 4 percent since 2017.

After its remarkable success in market growth, the initial policy sets have been running out of steam in recent years. For instance, the turnover growth rate appears to have peaked off. Trading in the GSM does not spread out across maturities but concentrates on one or two ten-year issues and the interbank market (Figure 15).

A utility is another concept to capture the development of an early-phase market. In the GSM development context, a utility refers to the trader's or the investor's preference, or value that the trader or the investor subjectively obtains from trading or market structure relative to alternatives, regarding trading objects, quantities, qualities, timings, modes, counterparts, and other trading behavior attributes. Its preference criteria inevitably involve non-monetary or psychological values, such as reliability, functionality, and convenience in consuming trading services. It is usually not objectively measurable but subjectively exploitable. This study refers to it as utility value, utility amount, or utility quantity when its measurement matters.

This study contributes to local policymakers, academics, and practitioners, including those in the IDC. The study's introduction of phase-differentiation through the TDPF first reifies the conflated and muddled concept of GSMs into an addressable and analyzable concept. This reification brings a GSM closer to local policymakers. Consequently, policy issues associated with GSMs should become more addressable for LIE governments than before. Second, the study opens a new research theme, GSM development in early-phase markets, for academics. The knowledge gaps regarding the research theme include endogenous causality in scarce resource economies, the properties and effects of utilities, and the interactions between exogenous and endogenous factors. Third, this study provides practitioners, including the IDC, with a new perspective and a guideline for program formulation.

The rest of the paper is structured as follows: Section 2 surveys literature about GSM development theories, case studies, and consumer theories. Section 3 overviews the Indian GSM. Section 4 presents a descriptive analysis of the CPF in the light of emerging economies. Section 5 lays out the TDPF. Section 6 explores the causalities of phase-fit and locally fit policy variables to market development of the Indian GSM. Section 7 discusses the TDPF's implications and India's experience as regards GSM development in LIEs. Section 8 concludes this work.

2 Literature Review

This study complements the prior GSM development literature with new approaches. The prior literature deals with GSMs in what could be considered a conflated manner and examines GSM development causalities from a macroeconomic perspective. In contrast, this study presents a phase-differentiated approach to GSMs and investigates GSM development endogenously. Figuratively, while the prior literature can explain half of GSM development, this study explains the other half. More important, GSM policymakers can take charge of the latter but not the former. In specific, this study contributes to the literature by discussing how to translate macroeconomic or exogenous opportunities into functional GSMs in LIE environments.

Following studies on GSM microstructure, such as Dattels (1995), Sundararajan, Dattels, and Blommenstein (1997), and Schinasi and Smith (1998) in the 1990s, the World Bank and IMF jointly took the lead in formulating the policy framework for GSM development in emerging economies through their monumental publication. World Bank and IMF (2001) overviewed theories, market structure, market practices and laid out policy measures to advance essential components of GSMs. Subsequently, World Bank (2007a, 2007b) assessed 12 emerging markets[7] against the "sound practices" of public debt management and GSM development that they established in their previous publication. As for the dynamics of market development, World Bank (2007b) points out the "chicken and egg" problems in market development (pp. 54 and 92) but stops short of elucidating their mechanism and policy solutions. Prior studies tend to spell out how to transplant the features and practices of GSMs in advanced economies into emerging economies.

More recently, a growing body of literature showcased the efforts that emerging economies made for local currency bond market development (Aguilar, 2006; Arif 2007; Arvai and Heenan, 2008; BIS, 2002; Castellanos & Martinez, 2006; de Brun, Gandelman, Kamil, & Porzecanski, 2006; De la Torre and Schmukler, 2007; Jiang & McCauley, 2004; Leal and Carvalhal-da-Silva, 2006; Sophastienphong, Mu, and Saporito, 2008; Sy, 2007; Szilagyi, Batten & Fetherston, 2003). Some other studies outline how markets have improved (Amante, Araujo, & Jeanneau, 2007; Silva, 2008; Sophastienphong et al., 2008). AfDB (2007, 2010) provides data on government debt markets' structures in 53 and 41 African countries. Blommestein and Horman (2007) and Berensmann, Dafe, and Volz (2015) also overview African debt markets along with their debt management practices. IMF and World Bank (2021) compile recent GSM development experiences and technical issues of middle-income economies into a guidance note for technical assistance programs.

An increasing number of macro-level cross-section studies searched for determinants of local currency bond market development. However, neither do those studies systematically distinguish emerging markets by development phases, nor do they explore the dynamics of market development determinants (Abbas & Christensen, 2007; Adelegan & Radzewicz-Bak, 2009; Akamatsu & Puongsophol 2017; Claessens, Klingebiel, & Schmukler, 2007; Hanson, 2007; IMF & World Bank, 2016; IMF, World Bank, EBRD, & OECD, 2013; Kumhof & Tanner, 2005; Panizza, 2008; Smaoui, Grandes & Akindele, 2017; Warnock & Burger, 2006). As a consequence of this research trend, market microstructure approaches have been rare until Endo (2020) questioned the validity of the PD system in LIEs.

The prior literature rarely sees GSMs as consumer markets where the investor consumes trading services that the trader provides and utilities that the government provides through a market structure. However, it is observed and theorized in consumer markets that the values, such as functionality, reliability, and convenience, often come before prices (Christensen, 1997a, 1997b; Gurowitz, 2012; Horton, n.d.; Moore, 2014). A life cycle also operates for new products, services, or technologies. Roger's (2003) diffusion of innovation theory portrays consumers' technology adoption behaviors with a logistic

[7] Bulgaria, Colombia, Costa Rica, Croatia, Indonesia, Kenya, Lebanon, Nicaragua, Pakistan, Sri Lanka, Tunisia, and Zambia (p. ix, World Bank 2007b)

curve, while Moore's (2014) technology adoption cycle model is comprised of four adoption stages characterized by consumers' unique psychographic profiles.[8]

India's GSM development path is well documented. Moitra (1983) portrays the Indian GSM before the Deregulation in 1991 as characterized by captive investors, artificial bond yields, and crowding-out of the private sector. Patil (2001) vividly lays out the detailed design of the Indian GSM that the RBI subsequently built. Reddy (2002) discusses the issues and dilemmas that the Indian debt market faced in its development until the GSM Reform. Mohan (2004, 2006) reviews the steady developmental path of the Indian GSM relative to its corporate debt market and presents prospective issues for the next leap. Mohan and Ray (2009) analyze the Indian debt market development by introducing three phases: the first phase (1992-95) in which India created the enabling environment, the second phase (1995-2000) in which the country built the market and institutional infrastructure, and the third phase (2001-) in which the market enhanced liquidity and safety. Mohan and Ray (2017) briefly refer to the bond market but discuss more the financial market settings in which the bond market developed.

The literature on the functional improvement of the Indian GSM is growing. Shankar and Bose (2008) confirm the efficiency of the auction system in the Indian GSM. Nath (2013) shows that the Turnover Ratio and the Amihud Illiquidity Ratio indicate the Indian GSM market liquidity well, but impact cost does not. Rajaram and Ghose (2015) review the evolution and explore primary dealers' functions in the Indian GSM. Fleming, Sareen, and Saggar (2015, 2016) analyze the current workings of the Indian GSM. They show the highly positive impact of the NDS-OM on the secondary as well as primary markets. Deuskar and Johnson (2016) find that Indian government securities' price dynamics are substantially attributable to the dynamics of the RBI's liquidity provision.

3 The Indian Market

3.1 Primary market

On behalf of the central government or state governments, the RBI issues government securities through auctions and underwriting. In consultation with the central government, the central bank issues indicative half-yearly auction calendars and subsequently updates them with more precise information. Auctions take place for Treasury bills and government bonds on Wednesdays and Fridays, respectively. Accepted bids settle on a T+1 basis. Auctions are open to all investors. Commercial banks, PDs, insurance companies, and other institutions that have funds accounts and securities accounts (Subsidiary General Ledger (SGL) accounts) with the RBI bid on the E-Kuber, that is, the RBI's Core Banking Solution (CBS) platform. Other investors or intermediaries bid through commercial banks or PDs called Aggregators/Facilitators (Fleming, Sareen & Saggar, 2015, 2016; RBI, 2019).

[8] "a combination of psychology and demographics that makes its marketing responses different from those of the other groups" (Moore, 2014, p. 15).

The central government and state governments have issued a substantial amount of debt. The total government debt outstood at 68.1 percent of the 2018 GDP.[9] Government securities, Treasury bills, and state development loans outstanding amounted to INR[10] 57,913 billion, INR 5,410 billion, and INR 28,158 billion, respectively, at the end of November 2019.[11] They accounted for 28.85 percent, 2.88 percent, 14.40 percent of 2018-19 GDP, respectively. The outstanding balance of state government loans also grew fast (Figures 4(2) and 6(2)).

3.2 Secondary market

The vast majority of the outstanding government securities trade on the NDS-OM. Other trading platforms include the "OTC market"[12] and stock exchange platforms such as BSE Direct[13] and the NSE's Negotiated Trade Reporting Platform[14] and Order Matching Platform.[15] The NDS-OM quickly overtook the "OTC market" from 49.64 percent of trades in 2004-05 to 91.21 percent in 2012-13, and 93.29 percent in 2019-20 (up to November 2019). The outstanding balances grew steadily over the years (Figures 4(2) & 6(2)). Outright trades increased from 77,060 trades and INR 5,134 billion in 2004-5 to 804,146 trades and INR 93,410 billion in 2018-19 at average compound annual rates of 18.24 percent 23.03 percent, respectively. Meanwhile, the OTC tends to trade larger-sized orders than the NDS-OM. In 2019-20 (up to November 2019), the OTC's average order size was INR 423.9 million compared to INR 113.6 million for the NDS-OM.[16]

The clearing and settlement are secured and efficient in the Indian GSM. The NDS-OM is STP-connected with the NDS. The RBI requires traders to report trades executed on other platforms to the NDS in 15 minutes of their execution and clear and settle them on the NDS (RBI, 2015, Articles 8.4 and 15.1).

3.3 Primary Dealer System

The RBI introduced PDs in 1996 following auctions for primary issuance that began in 1992. The RBI licensed nine PDs, subject to asset and performance criteria. Since the interest rate reverted upward in 2003-4 after consecutive eight years of decline, severe market losses made most PDs financially unsustainable. They had been highly leveraged. The FRBM Act of 2003 ended the RBI's intervention in auctions and made the issuance of government securities fully market-based in 2006. Subsequently, the RBI strengthened the PD system by reorganizing it under dual business models in 2006: three standalone PDs and ten bank PDs (Rajaram & Ghose, 2015). As of the end of December 2019, the GSM has seven standalone PDs (three foreign-owned PDs and four

[9] IMF. "total government debt" is "General government gross debt" as IMF defines at https://www.imf.org/external/datamapper/GGXWDG_NGDP@WEO/IND?year=2020
[10] The Indian Rupee. Spot rate: INR 71.73 per USD at the close of November 29, 2019. Retrieved from https://www.rbi.org.in/scripts/WSSView.aspx?Id=23407
[11] Table 5: Outstanding-Government Securities, Treasury Bills, and State Development Loans. (CCIL, 2019a)
[12] See Footnote 4.
[13] https://www.bseIndia.com/stastic/markets/debt/ncbGsec.html
[14] https://www.nseIndia.com/products/content/debt/wdm/reporting_system.htm
[15] https://www1.nseIndia.com/products/content/equities/slbs/trading.htm
[16] Calculated from the data in Table 27: Trading Platform Analysis of Outright Trades. (CCIL, 2019a)

domestic PDs) and fourteen bank PDs (six foreign banks, three domestic private banks, and five public sector banks).

The PD system in India's primary market is a hybrid of underwriting and competitive bidding. The issuance procedure of government securities is in two steps. First, the RBI sets and announces a "minimum underwriting commitment (MUC)" amount equal to 50 percent of the issue amount or more.[17] The RBI's Master Direction requires each PD to underwrite the MUC amount equally (a twenty-first of the MUC amount, at present). Second, the RBI auctions the remaining amount or additional competitive underwriting (AUC) amount. The Master Direction requires each PD to bid for at least its MUC amount (a twenty-first of the MUC amount) up to thirty percent of the AUC amount and an "underwriting commission" rate for its AUC bid amount. Bidding can be in uniform- or multiple-price form or on a price- or yield basis, as the RBI determines for each issuance. The RBI pays an "underwriting commission" to successful AUC bidders. The RBI also pays the AUC bidders who have won four percent or more of the issue amount a commission on their underwritten MUC amounts at the average rate of auctioned AUC "underwriting commission" rates weighted by accepted AUC bid amounts (RBI, 2019).

In the Evolving Phase, it is often observed that the market regulator does not fully enforce the PD's market-making in the secondary market. Strict enforcement of a two-way firm quote obligation exposes market makers to market risk unmanageable in most emerging markets. The RBI's Master Direction requires each PD to offer two-way firm quotes (market-making) and trade government securities outright annually five times or more than its average month-end stock (RBI, 2019).

India's selective enforcement of the PD's market-making obligations is sensible and effective in exploiting the primary market and simultaneously activating the secondary market (Endo, 2020). Table 2 lists a typical set of PD obligations. The RBI entices PDs into bidding or underwriting with fees and competitive pressures. The central bank enforces the trading volume norm for the secondary market but not the continuous firm bid-ask quoting obligation. PDs' market-making through two-way firm quoting is meant to help non-PD dealers, brokers, and end-investors trade with trading immediacy to meet their diverse needs. However, the Indian financial market was and is bank-centric. The RBI has not enforced the obligation on PDs unnecessarily.

4 Conventional Policy Framework (CPF)

The Framework that the World Bank and IMF jointly developed in the early 2000s considerably disseminated knowledge about GSMs to emerging economies. However, its unwitting bias for advanced economies suffered from some shortcomings for GSM development in LIEs. Firstly, it fails to differentiate GSMs by macroeconomic settings when working out policies for GSM development. This shortcoming may be called the single-universe problem. Secondly, it fails to distinguish market components (endogenous factors[18]) from fiscal and monetary preconditions (exogenous factors).

[17] Currently, the RBI sets the MUC at 50 percent of the issue amount.

[18] An endogenous (exogenous) factor in this study is an endogenous (exogenous) economic category that includes a numeric or string variable. By comparison, an edogenous (exogenous) variable is numeric.

This shortcoming may be called the indistinction problem. Thirdly, it fails to identify the coherent groups of interconnected market components. That is the incoherence problem. Fourthly, it fails to address dynamic feedback loops of interconnected market development processes. This shortcoming may be called the standalone-component problem**.**

The single-universe problem does not heed the policy's local specificity, such as the level, size, or properties of an economy. Usually, the level of household savings and the market structure dictates the potential of trading volume and market liquidity. The government's limited capacities and resources in an LIE may understandably compel GSM development to share capacities and resources with many other political, economic, and social objectives. Complex and high-cost market operations and development would be impractical in an LIE.

The indistinction problem does not distinguish endogenous market development issues from exogenous ones. This problem blurs the boundaries of responsibilities among fiscal, monetary, and GSM development authorities. The GSM policymaker for GSM may miss out on market development opportunities.

The incoherence problem likely comes from the practice that market development efforts are piecemealed or assigned discretely to individual specialists without overall coordination. This practice makes GSM development frictional, disorderly, or inefficient since a market component's workings are often bound by or pre-conditional to some other market components. For example, an electronic trading platform needs dematerialization. A central counterparty function requires novation. Grouping operationally or economically coherent features of market components as a policy set makes market development efficient.

The standalone-component problem may ignore the dynamic nature of market development processes. The processes are interdependent and looped, and they are likely to have different carrying capacities. Accordingly, they have to be managed so that no structural breaks occur in market development. A precedent process in interconnected processes needs to produce only as much output as economically and operationally acceptable to its dependent process or processes. Simultaneously, a dependent process can accept as much input as it may economically and operationally accept. Excessive output or input may be wasteful or harmful to a connected process or processes. Therefore, market development simultaneously involves multiple market components and is multifaceted, dynamic, and nonlinear. It is incremental, gradual, transtemporal, and comprehensive.

5 The Analytical Framework

5.1 GSM Development in Two-Dimensions

This research argues that GSM development can be viewed in two dimensions. The two dimensions form a ballpark policy matrix, as shown in the TDPF. The horizontal dimension is the Exogenous Dimension. It consists of factors exogenous to a GSM. Those factors include macroeconomic, fiscal, and monetary policies or conditions under which a GSM operates or develops. This Exogenous Dimension broadly divides the

universe of emerging markets into four development phases: the Nascent, Evolving, Advanced, and Highly-advanced Phases. GSMs in most LIEs fall in the Nascent or Evolving Phase. Each development phase forms a policy set paradigm[19] for market operations and development. By contrast, the vertical dimension is the Endogenous Dimension and comprises factors endogenous to a GSM. The GSM policymaker can usually manage these endogenous factors.[20] They include market components, such as accounting rules, legal rules, primary market, secondary market, money market, debt and cash management, clearing and settlement, and derivative and futures market. Thus, the two dimensions form a matrix of market components by market development phases.

A development phase on the Exogenous Dimension gives the GSM policymaker a realistic perspective on its GSM development horizon. The GSM policymaker is almost always part of a development phase. The policymaker can hardly upgrade its economy for GSM development in its capacity and during its tenure. A macroeconomic policy effect would be uncertain, and its response lag would be too long. An economy's position on the Exogenous Dimension spectrum generally sets the exogenous conditions of a GSM. These potentials and limitations shape a policy paradigm in which market components can coherently operate and develop. Fiscal and monetary policies or conditions are also exogenous to the market but less firmly preconditional to GSM development than macroeconomic ones. Thus, the Exogenous Dimension is a solution for a single-universe problem.

The TDPF provides the GSM policymaker with a practical and manageable policy space. The policymaker can improve upon its GSM by endogenously influencing the parameters of market components. The parameters are policies consisting of goals and measures manageable for the policymaker. Thus, the policymaker can practically contribute to GSM development.

Vertically grouped policies in the TDPF form policy sets and are inter-connected. They are a guideline for implementable policy sets in a given GSM development phase. The phase-coherent grouping selects the economically and operationally connected policies, least frictional in their interfaces, or least stressful on their connected processes. Thus, phase-coherently grouped policies are mutually congruent. Connecting policies should be neither too rudimentary nor too sophisticated, relative to their precedent and dependent policies. In this way, the Endogenous Dimension can mitigate an incoherence problem and a standalone-component problem.

The TDPF does not base its development phase classification on numerical parameters. Instead, the framework determines a market's development phase by comparing its functioning policies and institutional settings horizontally and vertically. A country can develop a GSM in a single development phase (intra-phase market improvement). A country's market may rarely shift from a development phase to another unless its economy goes through a significant structural change (inter-phase transition). The four phases, policy sets, and policies are reference guidelines. The policymaker should flexibly apply them to their GSM in the local context. A country's market may

[19] An operational framework of coherent policies set and its associated activities

[20] An endogenous (exogenous) factor in this study is an endogenous (exogenous) economic category that includes a numeric or string variable. By comparison, an endogenous (exogenous) variable is numeric.

implement policies that the matrix table assigns to the next or previous phase. Economies can also have different developmental goals. Every economy may not always want to advance to the highest possible market development phase. The pace of policy implementation may also vary, depending on actual market development and unfolding circumstances.

5.2 The Indian GSM in the Two-Dimensional Framework

The Indian GSM was in the Nascent Phase before starting the financial market deregulation in 1991 (the Deregulation). It entered the Evolving Phase after the Deregulation. The launch of the GSM Reform in the early 2000s enabled the GSM to leap. The catalysis was the CCIL, NDS, and NDS-OM. The World Bank recategorized the country from a lower-income country to a lower-middle income country in 2007.

Not many emerging economies can shift their market development phase over a decade or two. Nevertheless, India moved up the Exogenous Dimension to the Evolving Phase. After the move-up, the country substantially improved the GSM. As of the late 2010s, the country is about to enter the Advanced Phase. However, it did not follow the CPF. It implemented policy goals and measures suitable for the Evolving Phase. In the early 2000s, the RBI revamped its policy goals and measures to meet the economy's imminent needs and set realistic goals. India's financial market was bank-centric, and public sector banks were predominant. This financial market structure is common in Africa, Asia, and other emerging markets. Despite this market structure, the RBI needed to ensure market-based issuance of government securities and enhance secondary market liquidity.

The strategic core of its GSM development program was the NDS or the automated clearing and settlement system with a CCP function and the NDS-OM or the screen-based order-driven trading platform. They came into operation in 2001 and 2005, respectively, under the CCIL's management. The country supplemented a telephone-voiced, quote-driven OTC market with a screen-based order-driven market as government securities' principal marketplace. Continuous order-driven order-matching, that is, a typical order-matching system on stock exchanges, fits well with the market features of a GSM in the late Evolving or early Advanced Phase. The trading volume of the Indian GSM rose remarkably from 2005 to 2013 (Figures 3(1) and 4(1)).

The simplicity of government securities trading in an early development phase allowed the RBI to capitalize on the order-driven trading platform that the National Stock Exchange (NSE) successfully deployed in the 1990s.[21] The narrow trading choice largely balanced the supply and demand for immediacy (Grossman & Miller, 1988) and lessened the necessity of two-way quoting. Thus, I may view the NDS and the NDS-OM as an extension of the NSE market structure (Patil, 2001). Stock trading is mostly issuer-specific, and stock selection is hardly substitutable. Once a trader has picked up a stock, its trading decision parameter is mainly the price. Likewise, trading decisions in emerging GSMs, in contrast to advanced GSMs, are simple since the government is the only issuer, and liquid outstanding issues and trading strategies are considerably limited.

[21] The NSE's market structure pointedly addressed the concern of the Indian investment community in the 1990s in the advent of the Harshad Mehta scandal in 1992. The concern centered on the certainty, reliability, and safety of their trading and settlement.

India has developed a GSM on its bank-centricity rather than on a capital market. Neither was its investor base broad and deep, nor its non-bank intermediaries were well-capitalized. It was impractical for India's policymakers to transform their financial market structure for GSM development instantly. Bank-centricity is a typical financial market structure in the Nascent and Evolving Phases. The PD reform in 2006 further reinforced bank-centricity in the GSM by reducing standalone PDs and creating bank PDs. Of 21 licensed PDs, seven and fourteen PDs are standalone and banks, respectively, as of the end of December 2019 (Table 3).

India's GSM developmental path occasionally deviated from the Framework model favorably or unfavorably. It may deviate in the future as well. The country equipped its NDS with a CCP function when the market was still in the Evolving Phase. Given India's market development history, the CCP was an integral part of its strategic market structure. Many other countries may consider installing a CCP in the Highly-Advanced Phase. On the other hand, the Indian market has not fully adopted a mark-to-market accounting rule that the framework places as a policy measure of accounting in the Advanced Phase. Its attempt to run STRIPS and When-Issued on the market has not gained momentum.

6 Causality Analyses

6.1 The target variable

This section investigates endogenous market factors' causality to the trade volume growth in the Evolving Phase of the Indian GSM. As such, the trade volume is the target variable or dependent variable in this analysis.

6.2 Trading costs

The analysis indicates that the central bank fittingly employed the market growth policies from 2005 to 2013. The RBI's policies achieved trading "transparency and ease," repo market development, and competitive bid-ask spreads, among other things. The NDS and the NDS-OM have made GSM trading transparent and easy. Repo market development has been providing PDs with additional money management tools. The trading volume requirement imposed on PDs, which the RBI linked to auction and underwriting privileges, pressured and incentivized PDs to narrow bid-ask spreads competitively.

The reduction of trading costs resulting from these policies appears to have substantially increased trade volumes. Trading costs are inversely correlated to market liquidity (Madhavan,1992). Chaumont (2018) points to "a trade-off between the transaction costs and the trading probability" in the secondary market for sovereign bonds. These trading costs were observed in advanced markets where utilities necessary for trading were unquestionably available. In early phase markets, however, trading costs may be viewed as including bid-ask spreads and unavailable utilities. Accounting usually does not recognize the unavailable utility elements of trading costs. However, they significantly affect trading decisions in India's case.

Indian PDs' trading behavior reflects this broader concept of trading costs. I conducted semi-structured interviews with PDs in the Indian GSM and surveyed their market-

making practices in September and October 2019. The interviewees were trading heads and traders of 17 out of 21 PDs. The written survey followed the interviews, and ten PDs voluntarily answered the survey. Table 4 summarizes their responses.

The interviewed traders unanimously attributed their general preference for the NDS-OM over the telephone-voiced OTC market to "ease and transparency." Table 5 decomposes "ease and transparency" and relates its utility elements to the various trading cost components that the NDS-OM and the NDS are considered to have reduced. It is not straightforward to quantify these utilities in monetary terms, mainly because their benefits scatter across activities and facilities associated with trading. However, the increased prevalence of the NDS-OM and the narrowed bid-ask spreads on the platform suggest that the benefits of reducing total trading costs (bid-ask spreads plus unavailable utility values) exceeded the overall costs of the automated platform (market centralizing costs). Accordingly, my causality analyses proxy for the degrees of trading "transparency and ease" using NDS-OM trading percentages.

6.3 Data

This causality analysis sourced the raw market data of the Indian GSM mainly from the CCIL. The CCIL published the time series data from August 2005 to March 2019 in CCIL (2019a, 2019b), and the CCIL individually provided the same time series from April 2013 and October 2019. All the sample variables were monthly averages of their daily values that the CCIL observed on its system. Table 6 lists the sources and time ranges of the data.

Given the suspected autocorrelations of my time series variables, I had three hypothesized causal relationships to model the behavior of the trade volume: the vector autoregression (VAR), vector error correction (VEC), and autoregressive distributed lags (ARDL) models. I selected an appropriate model and specified the chosen model by examining the sample variables' properties and determining their order of integration. To this end, I tested the sample variables for multicollinearity, autocorrelation, optimal lag orders, and unit roots.

At first, I normalized the sample values of the variables relative to 100 at the beginning of each of the two subperiods, January 2007 and April 2013. The values were different in unit, and it is difficult to compare the degrees of their changes and capture their interactions in the raw values. The normalization (indexation) made their behaviors directly comparable. The symbol of each normalized variable was prefixed with "i" as its first-order difference was additionally prefixed with "d." (*e.g.*, *itrd* for the normalized value of a trade volume and *ditrd* for the first difference value of a normalized trade volume.) Table 7 provides the summary statistics of the raw as well as normalized data.

I split the sample period from August 2005 and October 2019 into two subperiods: January 2007 to March 2013 (the first-half period) and April 2013 to October 2019 (the second-half period) for three reasons. I dropped the 17 months from August 2005 to December 2006 since the period lacks bid-ask spread data. First, the percentage of NDS-OM trading underwent a structural change in April 2013, presumably due to policy intervention. The graphs in Figure 3 illustrated the structural change. For instance, the relationship between the trade volume (*itrd*) and the NDS share

(*indsom_pct*) changed radically (Figure 3(2)). The percentage of NDS-OM trading reached 90.2 percent in March 2007 and hovered between 87 and 95 percent after April 2013. Second, the two subperiods' separate analyses were likely to reveal the variable's behaviors specific to each of the two subperiods unambiguously. Third, I had two time series for bid-ask spreads, and neither of them ran through the entire data sample period. The first and second-time series covered the periods from January 2007 to December 2014 and from April 2013 to October 2019. The first time-series averaged the bid-ask spreads of all transactions, while the second one averaged the bid-ask spreads of only "liquid" government securities as categorized by the CCIL.[22] Therefore, the split kept the time series of bid-ask spreads coherent in each sub-period. I named the variable *ioldsprd* and *inewsprd* for the first- and second-half periods, respectively.

I decomposed composite variables in my raw data into component ones for my analyses, where the component ones might indicate market dynamics better. My dataset had three such cases. First, the trade value (*ivals*) consisted of the trade volume (*itrd*) and the trade size (*itrdsize*). The trade volume was redundant, and the trade size mirrored the trader's behavior straightforwardly. The second case was the turnover ratio. The variable was the composite indicator of the trade value (*ivals*) and the variable for the outstanding balance of government securities (*igsec*), both uniquely represented. I used the turnover ratio only when necessary. Third, the repo ratio (*irepos_pct)* was the ratio of the repo volume (*irepo*) to the trade volume (*itrd*).

I checked the independent variables' multicollinearity since I estimated regression models with the trade volume (*itrd*) as the dependent variable. Table 4-8 shows the correlation coefficients among variables. No correlation coefficients exceeded 0.95 in the first-half period. Therefore, I kept all the variables to consider for modeling for the first-half period. For the second-half period, however, the repo trade (*irepo*) had a correlation coefficient of 0.9545 with the outstanding balance of government securities (*igsec*), exceeding the threshold correlation coefficient of 0.95. I dropped the repo trade (*irepo*) for modeling for the second-half period. As a result, I had the independent variables of *igsec, indsom_pct, irepo, itrdsize,* and *ioldsprd* for the first-half period, and *igsec, indsom_pct, itrdsize,* and *inewsprd* for the second half period.

Figures 4, 5, 6, and 7 represent the level and first difference variables for the first-half period and the second-half period. The level graphs have the baseline at 100 (Figures 4 and 6) and the first difference ones at zero (Figures 5 and 7). In the first-half period, the *igsec* level variable follows an upward drift trend, and the level variables of the *itrd*, *indsom_pct*, *irepo*, and *itrd*size, also exhibit some upward trends. By contrast, that of the *ioldsprd* shows occasional positive clusters (Figure 4(6)). The *igec* first difference variable appears to fluctuate around a positive linear constant, while the other first difference variables are largely stationary around the zero mean (Figure 5). In the second-half period, the *igec* level variable continues to follow an upward drift trend (Figure 6(2)), but the other level variables no longer show an upward trend. Instead, the *itrd*, *itrd*size, and *inewsprd* level variables look like showing some cyclical trends (Figures 6(1), (4) and (5)) while the *indsom_pct* level variable stays close to the index

[22] Every month, CCIL categorizes outstanding issues into the liquid, semi-liquid, and illiquid securities, subject to the RBI's approval, and announces the list of categorized issues. There is no way to reconcile the two datasets for the first- and second half periods into a single time series with data available to this study.

value of 100 (94.81 percent in the raw value) with occasional dips (Figure 6(3)). Their first difference variables appear largely stationary around the zero mean except for the *igsec* first difference variable being stationary around a positive constant (Figure 7).

My investigation of the sample variables' properties started by testing them for autocorrelation.[23] I ran Durbin's alternative test (code: estat durbinalt) and plotted the autocorrelation functions. The majority of the level and first difference variables were autocorrelated, and so AR(1) models to fit the variables could not be estimated. Table 9 summarizes the results of Durbin's alternative test for the first-half and second-half periods. Figures 8, 9, 10, and 11 display the plots of the variables' autocorrelations over the first 20 autocorrelations against the confidence level of 95 percent.

I selected optimal lag orders of the level variables for the causality models by the Vector Auto-Regressive Specification Order Criterion (varsoc). I ran the varsoc on each variable with the highest lag order (maxlag) incrementally from two to eight.[24] According to the Akaike information criterion (AIC) and the Schwarz–Bayesian information criterion (SBIC), the result tables present optimal lag orders (Table 4-10). Since the sample sizes of the time series were not large (75 and 79 for the first-half and second-half subperiods, respectively), I focused on the SBIC for optimal lag order selections (Ventzislav & Lutz, 2005).

I performed the Augmented Dickey-Fuller test and the DF-GLS test (the modified Dickey-Fuller *t*-test) for unit root in the level and first difference variable time series. For the Augmented Dickey-Fuller test, I assigned lag orders of 4 and 3 to the level and first difference variables for the first-half period and 1 and 2 to the level and first difference variables for the second-half period, respectively, according to the varsoc calculation on the *itrd* variable (Table 11). Furthermore, I optionally included a trend or drift term in the Augmented Dickey-Fuller test regression or excluded the constant from the regression, based on the visual observations of Figures 4, 5, 6, and 7.

For the DF-GLS unit-root test, I optionally added a maxlag order of 11, as chosen by the Schwert criterion. Also, since DF-GLS unit-root test regressions included a trend term by default, I optionally included a notrend option in all the DF-GLS unit-root test regressions except for those level *igsec* or first difference d.*igsec* variables, as visually observed in Figures 4, 5, 6, and 7.

Finally, I performed the HEGY test on the *itrd* and *indsom_pct* variables for a seasonal unit root. The former was the dependent variable (the target variable) of this causality analysis, and its seasonality might, if any, mask the true market growth path. The latter was possibly the most influential independent variable as its correlation coefficient with the *itrd* variable suggested (Table 8), and the visual inspection showed its seasonal dip in every March or the last month of every fiscal year in India (Figure 12). Since the variables were monthly, I set the maxlag order at 12. I also specified the deterministic part of the test for "seasonal dummies and linear trend" and "seasonal dummies" for the first- and second-half periods, respectively, from a visual inspection of their line graphs in Figures 4(1) and 4(3) and Figures 6(1) and 6(3).

[23] My statistical software for these analyses is Stata version 16.

[24] Designating other variables as the exogenous variable option besides the constant in the vasoc command makes no material difference in the lag order selection statistics for my datasets.

6.4 Methodologies

I estimated the ARDL model and its error correction (EC) process (ARDL/EC model) to assess the variables' causality to the target variable. At first, I identified the likely lag order combinations for the valid ARDL/EC model. Then, the likely lag order combinations underwent the bounds tests to determine the possible presence of cointegration (long-run regressive relationship among the level variables) as well as their post estimation tests for the satisfaction of the assumptions underlying the ARDL/EC model (the integration conditions of I(0) and I(1) but not I(2)).[25] The post estimation tests included the Durbin-Watson test (code: estat dwatson) and the Breusch-Godfrey test (code: estat bgodfrey) for autocorrelation in the residuals, White's test for homoskedasticity (code: estat imtest, white), and the cumulative sum test for parameter stability (code: estat sbcusum).

A general representation of an ARDL(*p, q*) model is:

$$y_t = c_0 + c_1 t + \sum_{i=1}^{p} \phi_i \, y_{t-\mathrm{i}} + \sum_{i=0}^{q} \beta'_i \, \boldsymbol{x}_{t-\mathrm{i}} + \varepsilon_t \ , \qquad (1)$$

where $\boldsymbol{x}_t$is a k x 1 vector of variables in a time series, and *p* and *q* are optimal lag orders, and its ARDL/EC model is:

$$\Delta y_t = c_0 + c_1 t - \alpha(y_{t-1} - \boldsymbol{\theta x}_t) + \sum_{i=1}^{p-1} \psi_{yi} \Delta y_{t-i} + \sum_{i=0}^{q-1} \psi'_{xi} \Delta \boldsymbol{x}_{t-i} + u_t \ , \qquad (2)$$

where the speed-of-adjustment coefficient $\alpha = 1 - \sum_{j=1}^{p} \phi_i$ and the long-run coefficients are $\boldsymbol{\theta} = \frac{\sum_{j=0}^{q} \beta_j}{\alpha}$ (Kripfganz & Schneider, 2018). $\boldsymbol{\theta}$ or the long-run coefficients that bring back deviations to the long-run equilibrium, and ψ and ψ' or the short-run coefficients cause short-run fluctuations of the dependent variable *itrd* (the target variable).

I expanded Equations (1) and (2) to model my datasets. The dependent variable for the first-half period was *itrd,* and its independent variables were *igsec*, *indsom_pct*, *irepo*, *itrd*size, and *ioldsprd*, which I denoted *itr, ig, in, ir, its,* and *ios* for simple representation and prefixed their summation index *i* with "." to distinguish them from those variable indices. The ARDL/EC model for the first-half period was:

[25] The residuals of the ARDL/EC model are homoscedastic, serially uncorrelated, and stable over time (no structural change). (Kripfganz & Schneider, 2018, and others)

$$\Delta itr = c_0 + c_1 t - \alpha(itr_{t-1} - \boldsymbol{\theta x}_t) + \sum_{i=1}^{p-1} \psi_{itr.i}\, \Delta \boldsymbol{itr}_{t-i} + \sum_{i=0}^{q_{ig}-1} \psi'_{ig.i}\, \Delta \boldsymbol{ig}_{t-i} + \sum_{i=0}^{q_{in}-1} \psi'_{in.i}\, \Delta \boldsymbol{in}_{t-i} + \sum_{i=0}^{q_{ir}-1} \psi'_{ir.i}\, \Delta \boldsymbol{ir}_{t-i} + \sum_{i=0}^{q_{its}-1} \psi'_{its.i} \Delta\, \boldsymbol{its}_{t-i} + \sum_{i=0}^{q_{ios-1}} \psi'_{ios.i}\, \Delta \boldsymbol{ios}_{t-i} + u_t\,. \quad (3)$$

For the second-half period, by omitting *irepo* and replacing *ioldsprd* (*ios*) with *inewsprd* (*ins*), I obtained the following ARLD/EC model:

$$\Delta itr = c_0 + c_1 t - \alpha(itr_{t-1} - \boldsymbol{\theta x}_t) + \sum_{i=1}^{p-1} \psi_{itr.i}\, \Delta \boldsymbol{itr}_{t-i} + \sum_{i=0}^{q_{ig}-1} \psi'_{ig.i}\, \Delta \boldsymbol{ig}_{t-i} + \sum_{i=0}^{q_{in}-1} \psi'_{in.i}\, \Delta \boldsymbol{in}_{t-i} + \sum_{i=0}^{q_{its}-1} \psi'_{its.i} \Delta\, \boldsymbol{its}_{t-i} + \sum_{i=0}^{q_{ins-1}} \psi'_{ins.i}\, \Delta \boldsymbol{ins}_{t-i}\; u_t\,. \quad (4)$$

I ran Equations (3) and (4) on the sample variables with selected lag order combinations to estimate the model's long-run and short-run parameters.

The ARDL/EC model's specification sensitivity centered on selecting lag orders for the sample variables or lags(p q_{ig} q_{in} q_{its} q_{ir} q_{ios}) for the first-half period and lags(p q_{ig} q_{in} q_{its} q_{ins}) for the second-half period. Stata's ARDL software module automatically assigned lag orders for each of the dependent and independent variables. Their results did not necessarily clear the post-estimation tests. Therefore, I also applied the lag order combinations that the varsoc test identified by Schwarz's Bayesian information criteria (SBIC) (Tables 10 and 11) or empirically assigned varying combinations to determine the optimal combinations of lag orders that passed all the post estimation tests.

Finally, I estimated the impact of the *igec* and *indsom_pct* variables on the ARDL/EC regression's explanatory power by dropping them in sequence and verifying lag order combinations with post estimation tests. The differences that dropping a variable from the regression makes in R-squared were expected to measure the variable's impact on the *itrd* variable or the trade volume (stepwise method).

6.5 Results

The results shown in Table 9 and Figures 8 to 11 confirm my sample variables' autoregressiveness either in level or in first difference or both. Notably, the *indsom_pct*

variable was non-autoregressive in level but autoregressive in first difference for the first-half period.

Table 10 shows the optimal lag orders that the varsoc suggested for the max-lag orders from 2 to 8. Table 11 summarizes the results shown in Table 10. I applied these suggested optimal orders to the Augmented Dickey-Fuller test and the DF-GLS unit-root test for unit root.

Tables 12 and 13 report the DF-GLS test results, and Table 14 reports the Augmented Dickey-Fuller test results for unit root. These results confirm that the sample variables were integrated of order 0 (I(0)) or order 1 (I(1)).

The HEGY test results for seasonal root indicate they had unit roots individually but not jointly and had non-seasonal unit roots (unit roots at the zero-frequency) (Table 15). The results are not entirely consistent with those of the Augmented Dickey-Fuller test (Table 14) and the DF-GLS unit-root test. The dubious monthly seasonality in the variables does not seem as significant as it may affect the long-run causality.

The above findings are consistent with the ARDL/EC modeling assumptions subject to the post-estimation tests. The confirmed mixed presence of unit roots disqualifies either a VAR model or a VEC model for modeling my data.

The estimation of the ARDL/EC model parameters with likely lag order combinations was subjected to the post estimation tests. Table 16 summarizes the results of the post-estimation tests. The cumulative sum test confirmed no structure breaks either in the first-half period or in the second-half period (Figures 13 and 14). All the results suggest that the best-fit lag combinations were lags(*2 1 1 1 1 1*) and lags(*1 1 0 1 0*) for the first- and second-half periods, respectively.

Table 17 presents the ARDL/EC's parameters estimated with the best-fit lag combinations. In the first-half period, the R-squared was 51 percent, explaining the independent variables' contribution to the *itrd* or the dependent variable. A long-run level relationship was evident, but no statistically significant short-run relationships were present except for the *igsec*. In the long-run error correction term, only the *igec* and the *indsom_pct* were statistically significant. Their coefficients indicate that one-percent increases of the *indsom_pct* and the *igsec* raised the *itrd* by 4.71 percent and 1.24 percent, respectively. The *igsec* had a standard error of 0.32 and a *t*-statistic of 3.89, while the *indsom_pct'*s standard error and t-value were 2.32 and 2.03.

In the second-half period, the R-squared was 49 percent. The speed of adjustment had weaned to -0.64. The *igsec* no longer contributed to the *itrd* growth either in the long run or in the short run. Instead, the *indsom_pct* remained statistically significant in coefficient to the *itrd,* and the *itrdsize* so became. The *indsom_pct*'s coefficient increased to as large as 10.82 while its standard error changed little at 2.31. Its *t*-statistic jumped accordingly. No short-run relationship was found.

The impacts of the government securities balance and the NDS-OM variables are summarized in Tables 19 and 20. Excluding the *igec* variable from the regression lowered the R-squared from 51 percent to 40 percent for the first half period and from 49 percent to 42 percent for the second-half period (Tables 19(1) and 20(1)). Further,

ignoring the *indsom_pct* variable reduced the R-squared from 40 percent to 18 percent[26] for the first half period and from 40 percent to 25 percent for the second-half period (Tables 19(2) and 20(2)).

7 Discussion

The CPF for GSM development has so far failed to deliver expected results to LIEs. This research attempted to improve upon the CPF. It questioned how effective policy sets could be developed for GSM development in LIEs and if any policy framework could help formulate the policy sets. These questions aimed at finding a way for ahe GSM policymaker to facilitate and reinforce the macroeconomic advancement of its economy.

The results evidence endogenous market factors' significant contribution to market development in its early phases. This study measured the contribution of an independent variable in terms of differences in R-squared values calculated by stepwise methods. The GSM policymaker can make the most of them. In India's case, all the independent variables explained 51 percent of the trade volume (*itrd*) growth in the first-half period (Table17). The balance of government securities (*igsec*) was a fiscal policy variable. Excluding it, the endogenous variables explained 40 percent (Table 19(1)). The 51 percent can be broken down into 10 percent for the government securities' balances (*igsec*), 22 percent for the market infrastructure innovation (the NDS-OM percentages) (*indsom_pct*), and 18 percent for the rest of the variables (Table 19(2)). These weights should not be taken as independent since they are cointegrated. Also, more precisely, they contributed to changes but not necessarily growth in the trade volume. Nonetheless, I view their positive changes as contributions to growth. By contrast, the second half period manifested a fiscal policy variable's limitation. The continued growth of the government securities balance could not pull up the trade volume. All the independent variables explained 49 percent of the trade volume changes when its growth was almost flat (Table 18). The NDS-OM percentages and the other endogenous variables together accounted for 42 percent, separately 16 percent and 26 percent, respectively (Table 20). The balance of government securities was no longer statistically significant at a p-value of 0.065, and its coefficient was even negative (Table 18).

The NDS-OM in India's context had two implications: a locally-fit and phase-fit market structure and hidden utility exploitation. Firstly, adopting the new market structure was timely and fitting for the GSM in the Evolving Phase. The Indian GSM adopted an order-driven model for its automated trading platform instead of a quote-driven model, which most advanced markets use and the IDC usually recommends. In an early development phase, the trading choice is relatively narrow as liquid issues are limited in number, the investor base is small or homogeneous, and trading and investment techniques are simple. The relative simplicity more likely balances the supply and demand for immediacy (Grossman & Miller, 1988). India could extend its locally developed and successfully implemented stock market model to the GSM.

[26] At 18% for the R-squared, the bounds test failed against the 1% critical value of t-statistic (Table 19).

Secondly, the NDS-OM also meant uncovering hidden "universal" utilities embedded in the Indian GSM's market structure. Utilities are economic agents' perceptions, and they are objectively unmeasurable but may be exploitable. They can be grouped into universal utilities and trader-specific ones. The former affects all traders across the market as the trading "transparency and ease" did in the Indian GSM. The NDS-OM as a component of a market structure generates "universal" utility values. It may also take the form of eliminating or reducing social or political rent, a negative market structure component. They are more apparent in the early stages than the later ones of a market development phase before most traders become price-takers. By contrast, the latter is specific to particular individuals or groups to satisfy their individual non-yield-seeking needs. The trader-specific utilities are what Harris (2003) analyzes as utilitarian trading benefits (pp. 178-194). Trader-specific utilities are more often observable in a highly liquid market, where most traders are price-takers. Also, many heterogenic traders participate in trading and take trader-specific behaviors in the Highly Advanced Phase. Utilitarian traders may be willing to pay a premium for trading. In this context, "traders" are investors or proprietary traders rather than intermediaries.

Consumption theories developed in the real economy suggest the dominant role of utilities in early development phases of the Indian GSM. The observed role of utilities in motivating the investor to trade in the early phases of the Indian GSM is a common case with industrial and retail consumers' buying behaviors in imperfect markets. It is known that non-pecuniary values, such as functionality, reliability, or convenience, dominate industrial or retail consumers' buying decisions in early phases of their product life cycles or imperfect markets (Christensen, 1997a, 1997b; Gurowitz, 2012; Horton, n.d.; Moore, 2014). The Indian investor's behavioral evolution over time in the Evolving Phase is also consistent with consumption theories. Its utility consumption was gradual, accelerated, decelerated, and stalled in the NDS-OM's capacity life cycle. This pattern fits Roger's (2003, pp. 168-218) innovation-decision process model and Moore's (2014, pp. 11-17) technology adoption cycle model.

Consequently, the bid-ask spread's insignificance suggests that implicit and indirect trading costs (utility values) could or should be addressed before bid-ask spreads. The bid-ask spread narrowing did not significantly increase the trade volume throughout the observation period, though the spread narrowed to as small as one to three basis points (Table 7(2)). The bid-ask spread, which is an explicit and direct trading cost, is inversely correlated with the trading volume in advanced securities markets (Chaumont, 2018; Madhavan,1992). GSMs in LIEs, as the Indian GSM exemplifies, are likely to contain implicit trading costs or utility values abundantly.

Effective GSM development policies are phase-fit, phase-dependent, and path-dependent. The policymaker most likely finds high-leverage policies or their variations in the column of its development phase in the TDPF. India's introduction of a screen-based automated trading platform in 2005 typified a phase-fit policy measure after the country had fostered market environments in the 1990s and the early 2000s. Relevance, timeliness, sequence, and coherence are crucial to overall policy effectiveness in the local context. Table 21 shows the general alignment of India's policy measures and the TDPF.

A high-leverage policy's strength would, like India's NDS-OM, be temporal and conditional. Environmental changes or intrinsic conditions may dwindle the policy's effectiveness. Thus, the high-leverage policy may shift, even in the same development phase. Subsequently or even preemptively, the policymaker may also have to reset market development targets or goals to keep up with the changes. Despite its continued statistical significance, the NDS-OM that had saturated the market structure's carrying capacity could not raise the trade volume in the second half period. Since the government securities balance continued to grow, the structure of India's financial market seems responsible for the market growth lull (Figures 6(1), (2), and (3)). This lull suggests that an endogenous market development policy is subordinate to exogenous policies and environments.

Nonetheless, market environments may not always be rigidly exogenous to the market. Fiscal and monetary settings are likely to be less unmanageable than macroeconomic ones though they are exogenous to the market. The legal or working relationships among market development, fiscal, and monetary authorities can make fiscal and monetary environments less rigid. An example is India's Fiscal Responsibility and Budget Management Act of 2003 (Table 21).

The NDS-OM case exemplifies the manageability of endogenous market factors for the GSM policymaker. The fiscal-year-end dips of the NDS-OM trading and the maintenance of a residual space for OTC market trading illustrate the policymaker's ability to control market development processes to meet its policy or operational objectives. The GSM policymaker is not responsible for macroeconomic policies. Their policy effects are holistic, and their policy lags are long, as the TDPF's vertical dimension indicates. Monetary and fiscal policies are closer to the GSM policymaker, but they usually are outside the GSM policymaker's responsibility. Their objectives are not GSM development. The GSM policymaker is accountable for endogenous market factors. They can be well-focused under the GSM policymaker's control, and their effects can be somewhat foreseeable, if not instant.

Policy consistency pays off – it respects the mid- to long-term and coherent grouping of policies in a development phase. Even endogenous market improvement in a development phase may take a few decades. It is a long time relative to the policymaker's tenure in office. The Indian GSM took 22 years to level off in 2013 and 28 years to reach this research point in 2019. Nonetheless, it appears too early to say that the Indian GSM has fully graduated from the Evolving Phase and has entered the Advanced Phase.

India's successful GSM development has left some problems unresolved or given rise to unintended consequences for the next phase. For instance, the quality of liquidity is an issue facing the Indian GSM, often the case with other GSMs in the Nascent or Evolving Phases. The three most actively traded issues accounted for 67 to 87 percent of all trades in 2019. Two ten-year issues are almost always predominant (Figure 15). These concentration features presumably led to unusually narrow bid-ask spreads (Table 7(2)). The liquidity-centric trading in a bank-centric market, unlike yield-seeking trading, tends to converge on a few GS issues through a feedback (self-reinforcing) effect and consequently keep the liquidity inside the interbank market.

Though not uncommon in the Nascent and Evolving Phases, these concentrations are undesirable for a GSM of capital market type. First, the concentration may cause non-PD and non-bank traders to perceive adverse selection and information asymmetry problems. These problems may discourage them from actively trading in the GSM though their participation would bring in heterogeneous views and improve the GSM's price discovery efficiency. Second, the liquidity concentration and the spread squeeze form an "entry barrier" in the GSM. The entry barrier would keep it more challenging for non-PD institutions to enter the market and extend financial efficiency beyond the interbank market or across the economy. Third, it may also segment the term structure of interest rates and weaken the transmission mechanism.

The next leap of India's GSM may have to wait for its financial market structure to deepen, broaden, and diversify further. The leap may have already started as the *trdsize* increased and became statistically significant (Table 18). A financial market structure is a long-term set of institutions, policies, laws, and regulations aligned for financial transactions or the way they are organized. A government builds and maintains a particular financial market structure to achieve its policy or political goals in the long run. India's current financial market structure is bank-centric. The TDPF suggests broadening the investor base and deepening the financial market structure, among other things, for the next phase.

This research has several limitations. First, it could test the TDPF on an ex-post basis only with the Indian GSM's development path. Empirical studies of other lower-income markets may present different perspectives. Second, my observed endogenous variables are exclusive but not necessarily exhaustive. Other unobserved variables may become measurable. Endogenous factors' interactions with exogenous ones were not addressed. Third, most of my data were monthly averages of daily observed values, and their daily changes had been smoothed out. Nevertheless, since my focus is on long-run relationships, I assume that the monthly averaging had a minimal impact on my research results.

Another caution is that India might have had some lucks for GSM development uniquely. Its lucks may include a successful stock market reform experience just before the GSM reform, a pool of local IT talents, and traditional intellectual independence. All LIEs may not equally share such lucks.

8 Conclusion

This research has explored the endogenous policy sets and the policy framework for GSM development in LIEs. It has proposed the TDPF to answers these challenges systematically. The framework is designed to coherently develop a GSM to facilitate or reinforce its macroeconomic and social achievements. It is also expected to help the academic and policy advisor conceptualize market development programs for the policymaker.

LIEs need a practical framework of implementable policy sets to translate economic and social achievements into tangible policies for GSM development or connect tangible policies endogenously as well as exogenously. The key concepts underlying the proposed policy framework are sensible differentiation of GSMs by their development

phases (phase-differentiation) and endogenously coherent policy sets for phase-differentiated GSMs (phase-coherency).

The Indian GSM showcased that endogenous market factors explained about 40 percent of the trade volume growth. India's leading variable was the phase-fit and locally-fit automated market structure, which released embedded universal utilitiesvalues. Its contribution is estimated at 22 percent of the trade volume growth. These laudable contributions of endogenous market factors compel us to organize known GSM policy sets for LIEs into the TDPF. The framework can be a Treasure Island map for LIEs when they systematically develop or improve their GSMs.

The absence of a phase-fit, locally-fit approach and endogenously phase-coherent policy sets would keep LIEs financially inefficient.

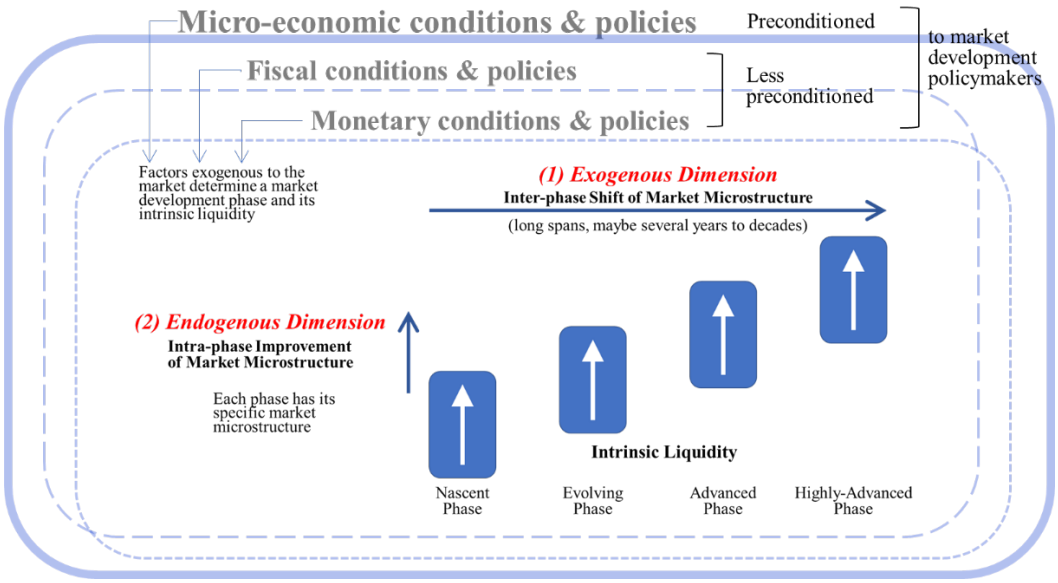
An agenda for further research could include ex-ante testing and improvement of the TDPF with various LIEs, the role of utilities in market structure's evolution and market phase transition, and the interactions between exogenous and endogenous GSM development factors.

Acknowledgments

I thank the anonymous reviewers for their careful reading of my manuscript and their insightful comments and suggestions. I also gratefully acknowledge the support,advice and comments of Aditya Narain, Chandan Sinha, Golaka C. Nath, Christian Otchia, Masakazu Someya, and India's RBI officials and market practitioners. However, all errors are the author's responsibility.

Figures

Figure 4-1: Two-Dimensional Market Development



Source: The Author

Figure 4-2: Turnover Growth and Lull

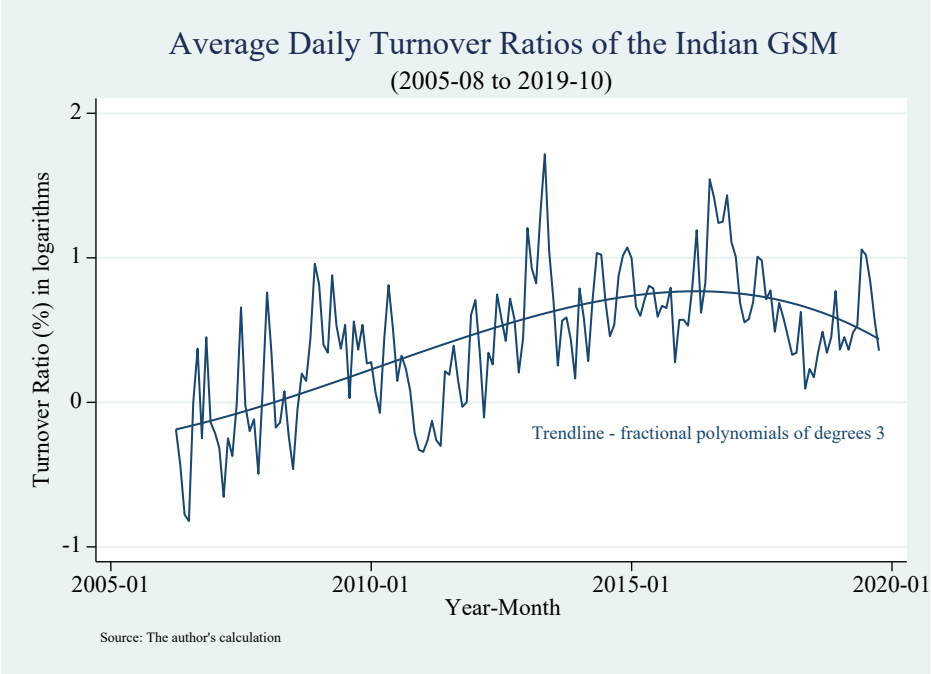
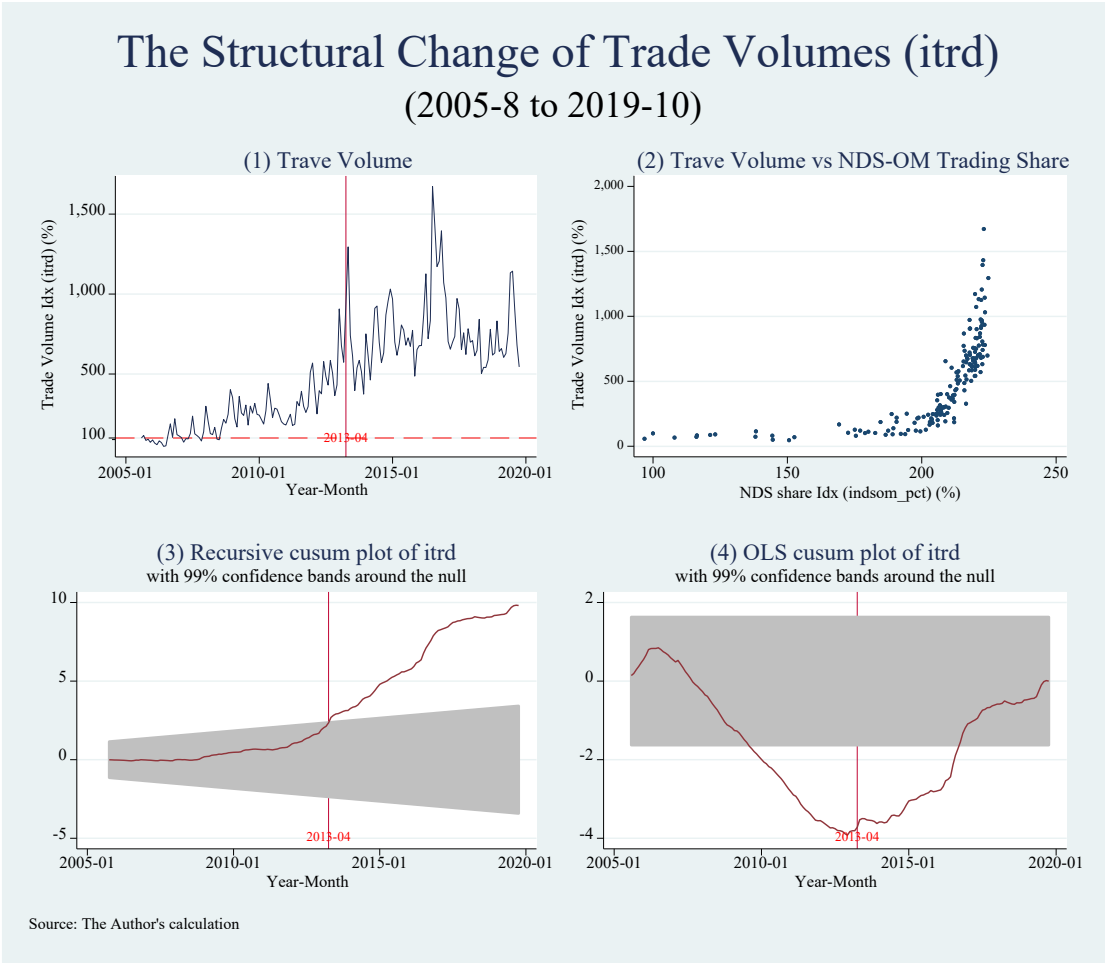


Figure 4-3: The Structural Change of the Indian GSM in April 2013



Source: The Author's calculation

Figure 4-4: Normalized Level Variables for the First-half Period (2007-01 to 2013-03)

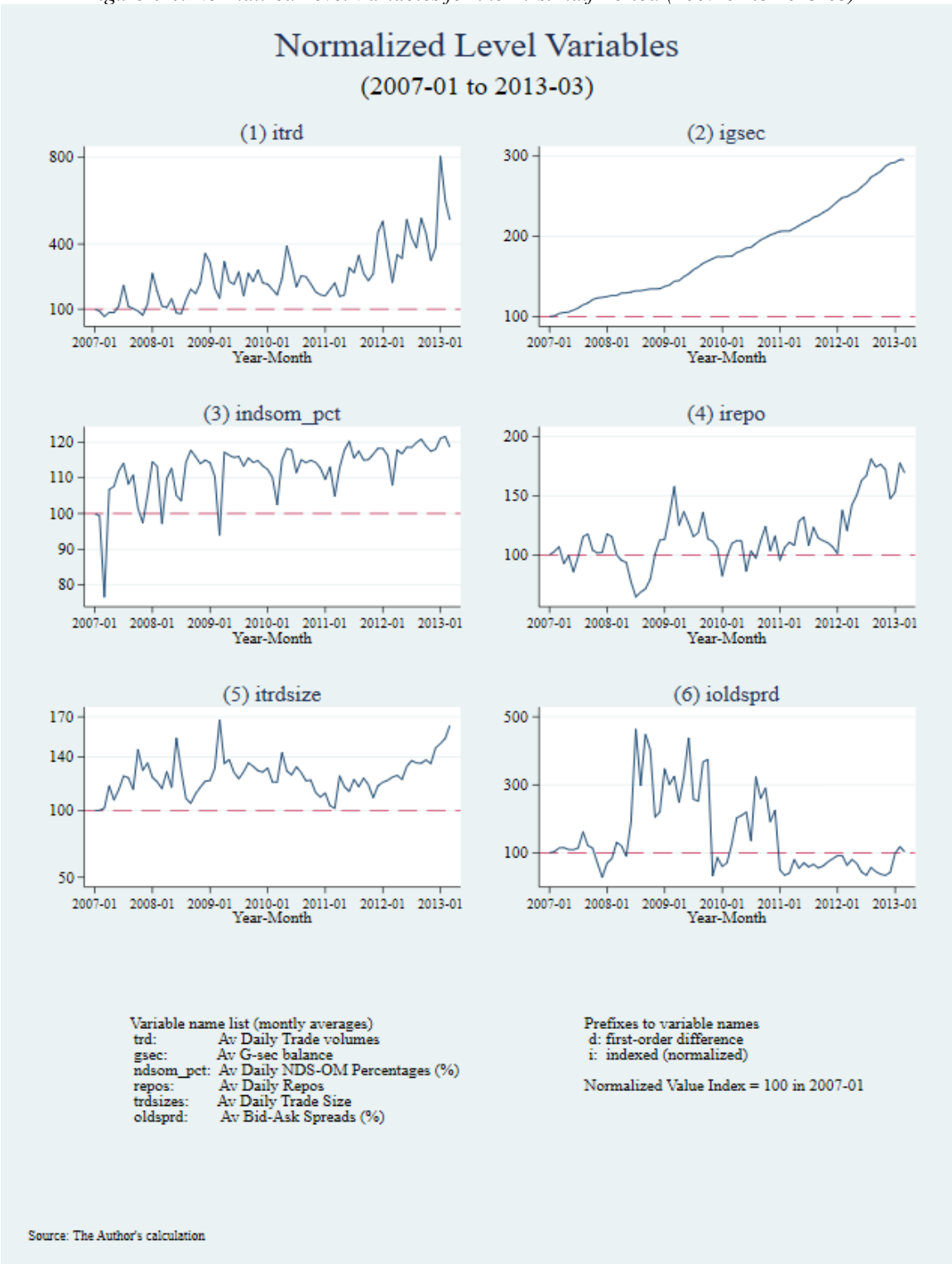


Figure 4-5: Normalized First Difference Variables for the First-half Period (2007-01 to 2013-03)

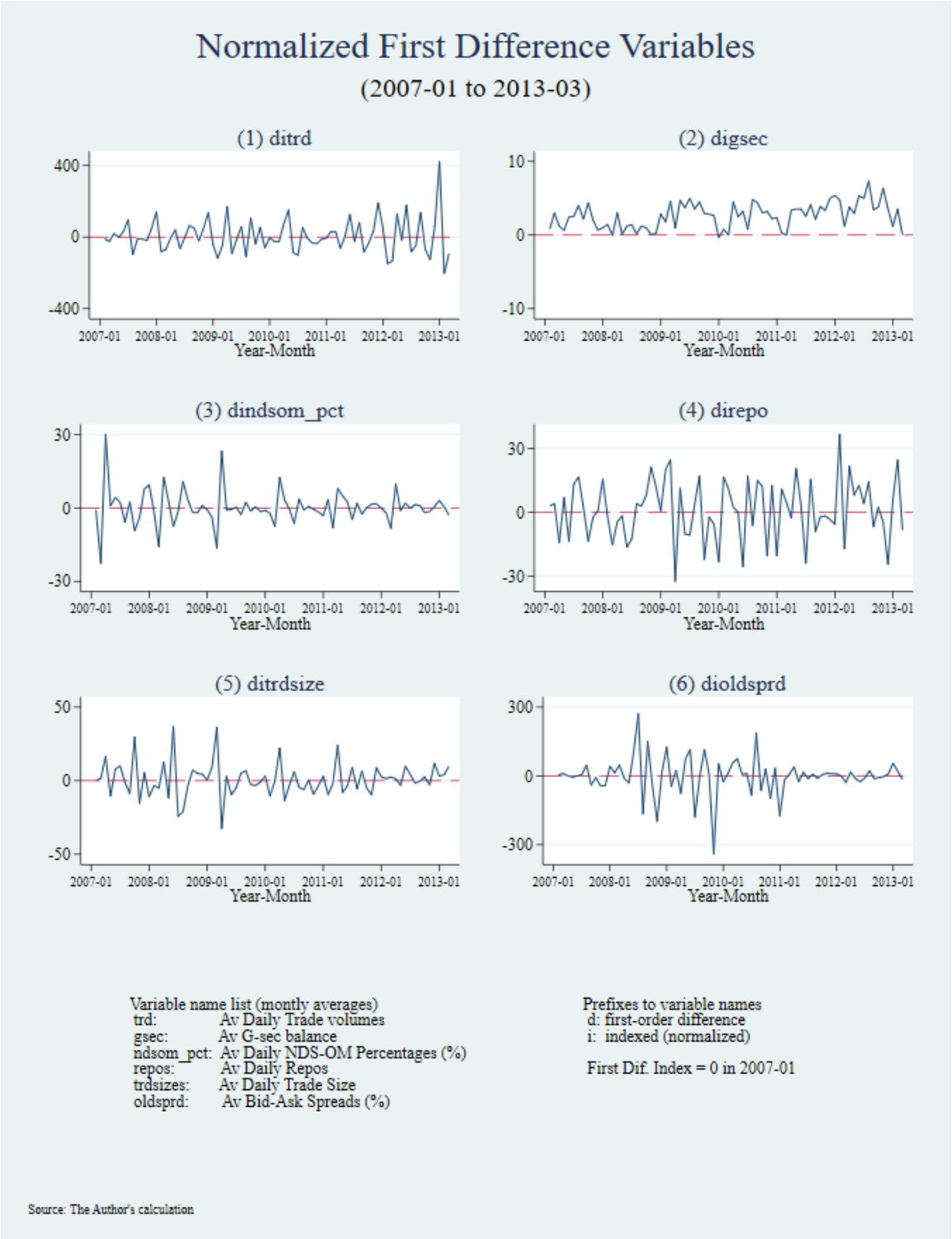


Figure 4-6: Normalized Level Variables for the Second-half Period (2013-04 to 2019-10

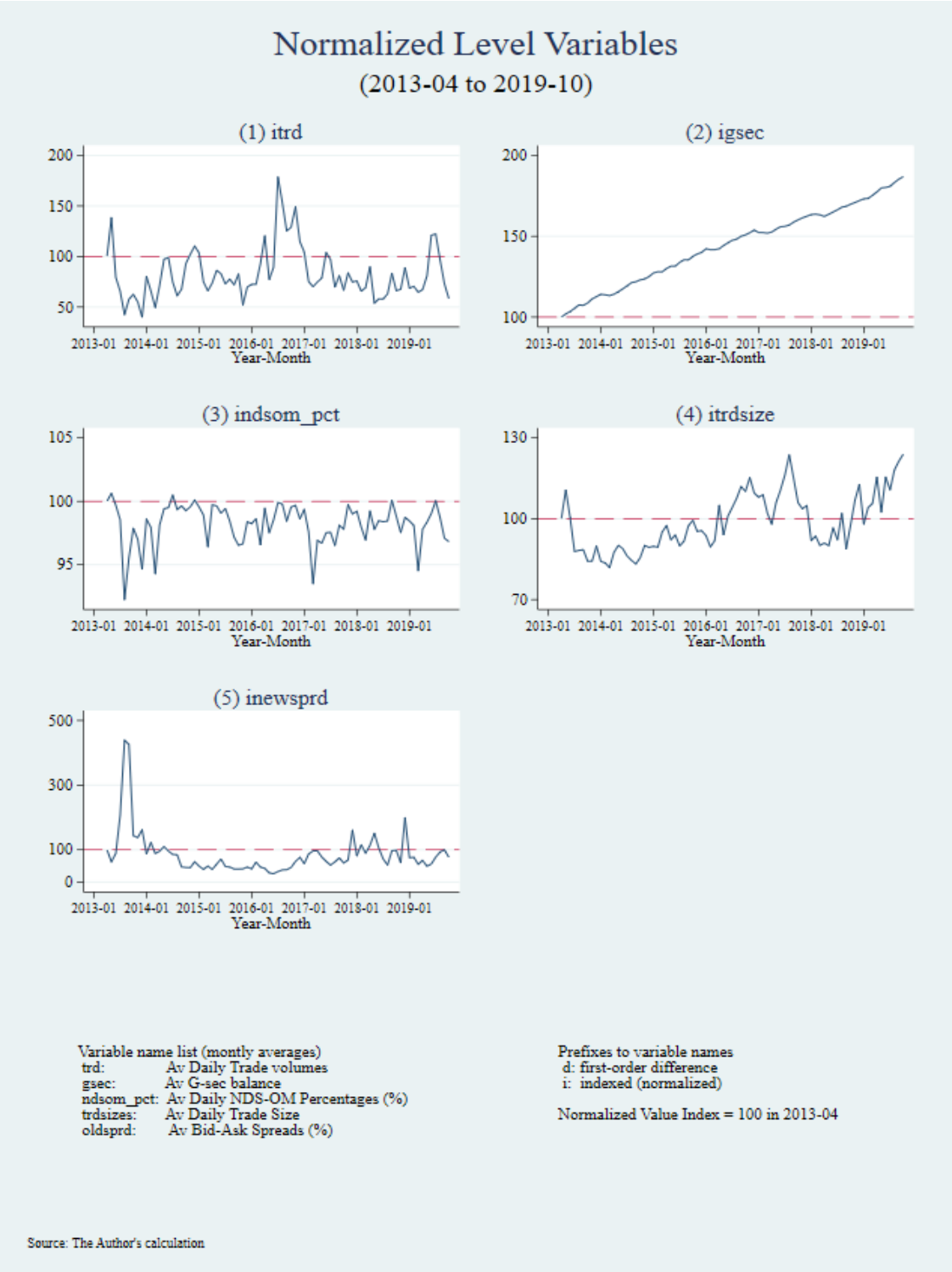
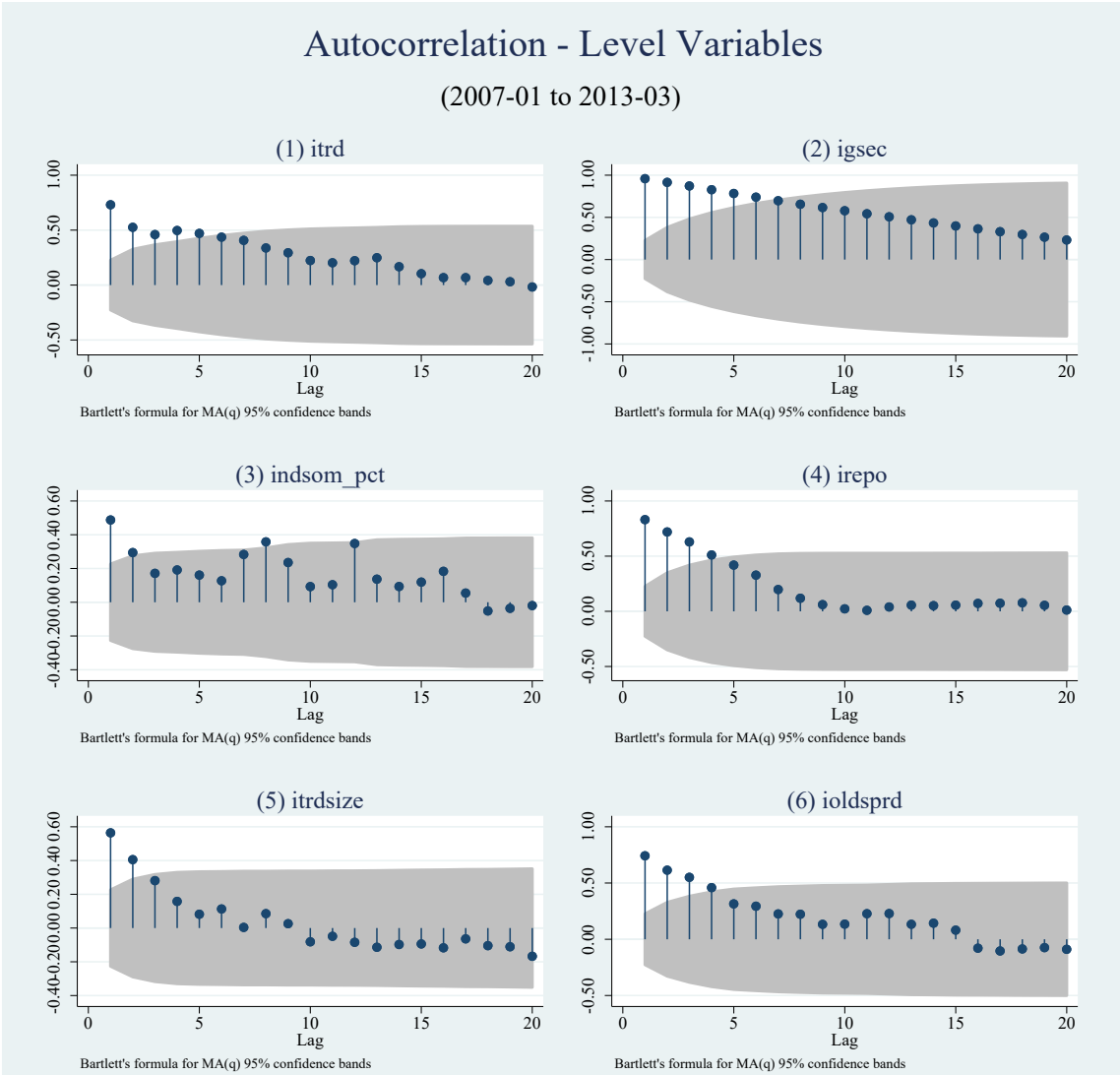


Figure 4-7: Normalized First Difference Variables for the Second-half Period (2013-04 to 2019-10)

Figure 4-8: Autocorrelation Plots - Level Variables for the First-half Period (2007-01 to 2013-03)

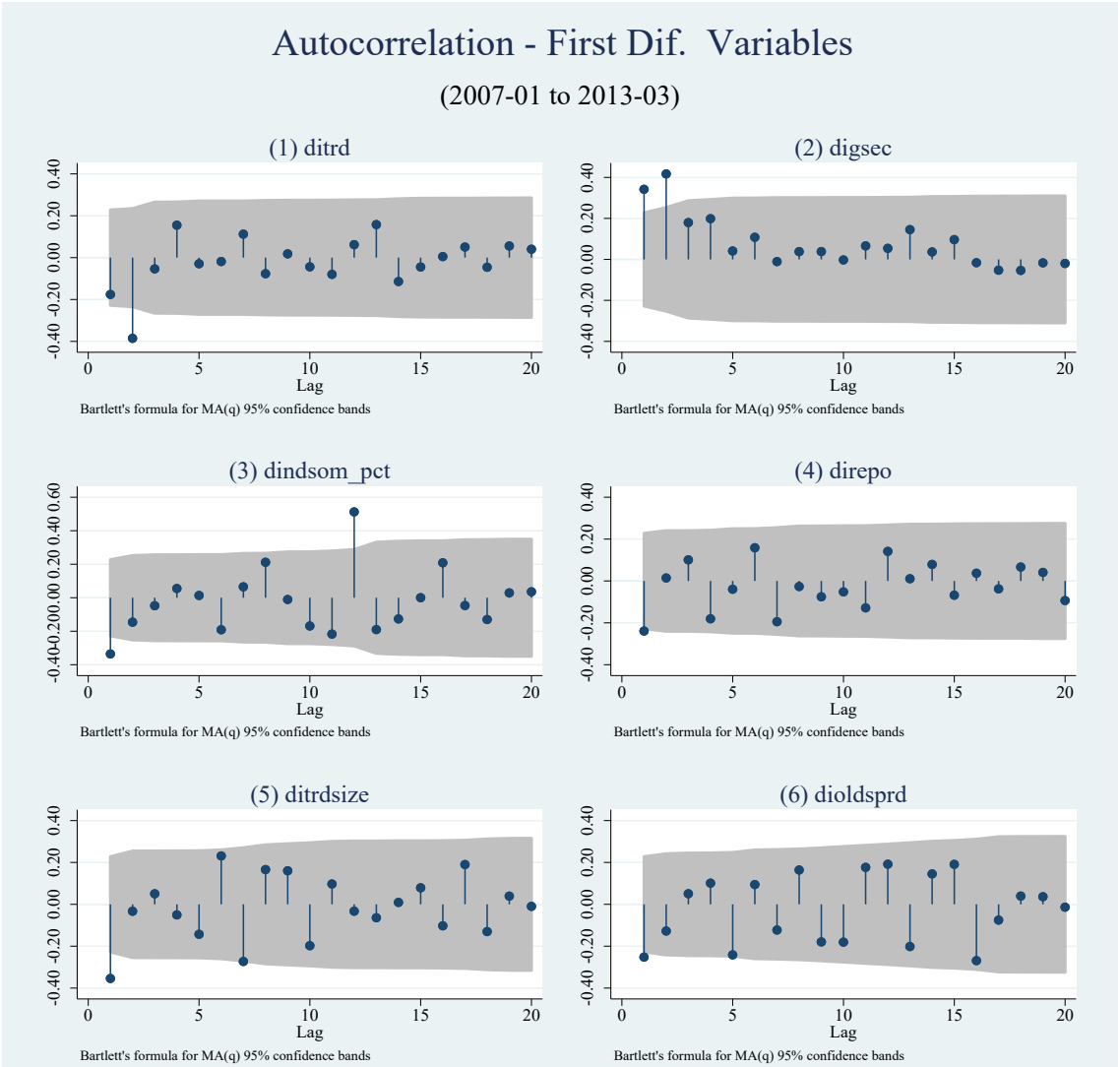


Variable name list (montly averages)
trd: Av Daily Trade volumes
gsec: Av G-sec balance
ndsom_pct: Av Daily NDS-OM Percentages (%)
repos: Av Daily Repos
trdsizes: Av Daily Trade Size
oldsprd: Av Bid-Ask Spreads (%)

Prefixes to variable name
d: first-order difference
i: indexed (normalized)

Source: The Author's calculation

Figure 4-9: Autocorrelation Plots - First Dif. el Variables for the First-half Period (2007-01 to 2013-03)



Variable name list (montly averages)

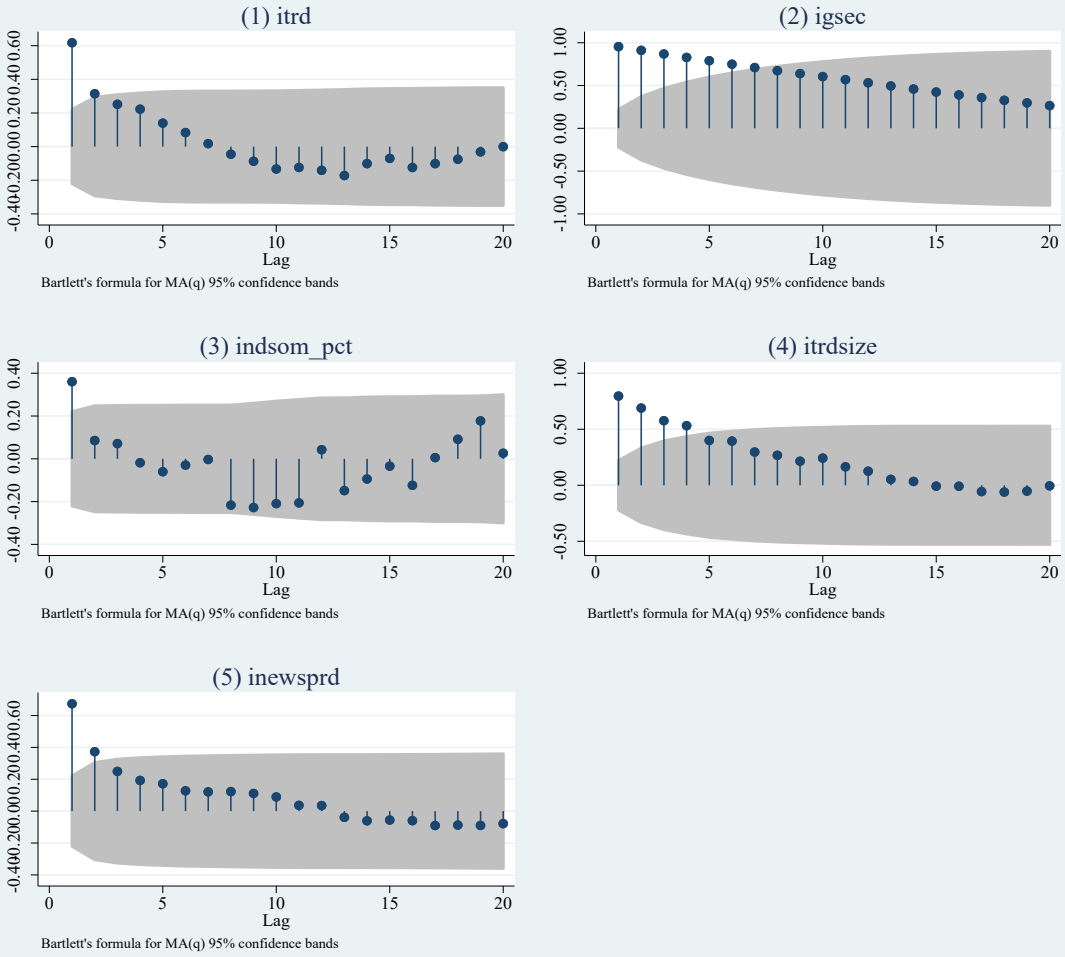
trd:	Av Daily Trade volumes
gsec:	Av G-sec balance
ndsom_pct:	Av Daily NDS-OM Percentages (%)
repos:	Av Daily Repos
trdsizes:	Av Daily Trade Size
oldsprd:	Av Bid-Ask Spreads (%)

Prefixes to variable name

d:	first-order difference
i:	indexed (normalized)

Source: The Author's calculation

Figure 4-10: Autocorrelation Plots - Level Variables for the Second-half Period (2013-04 to 2019-10)

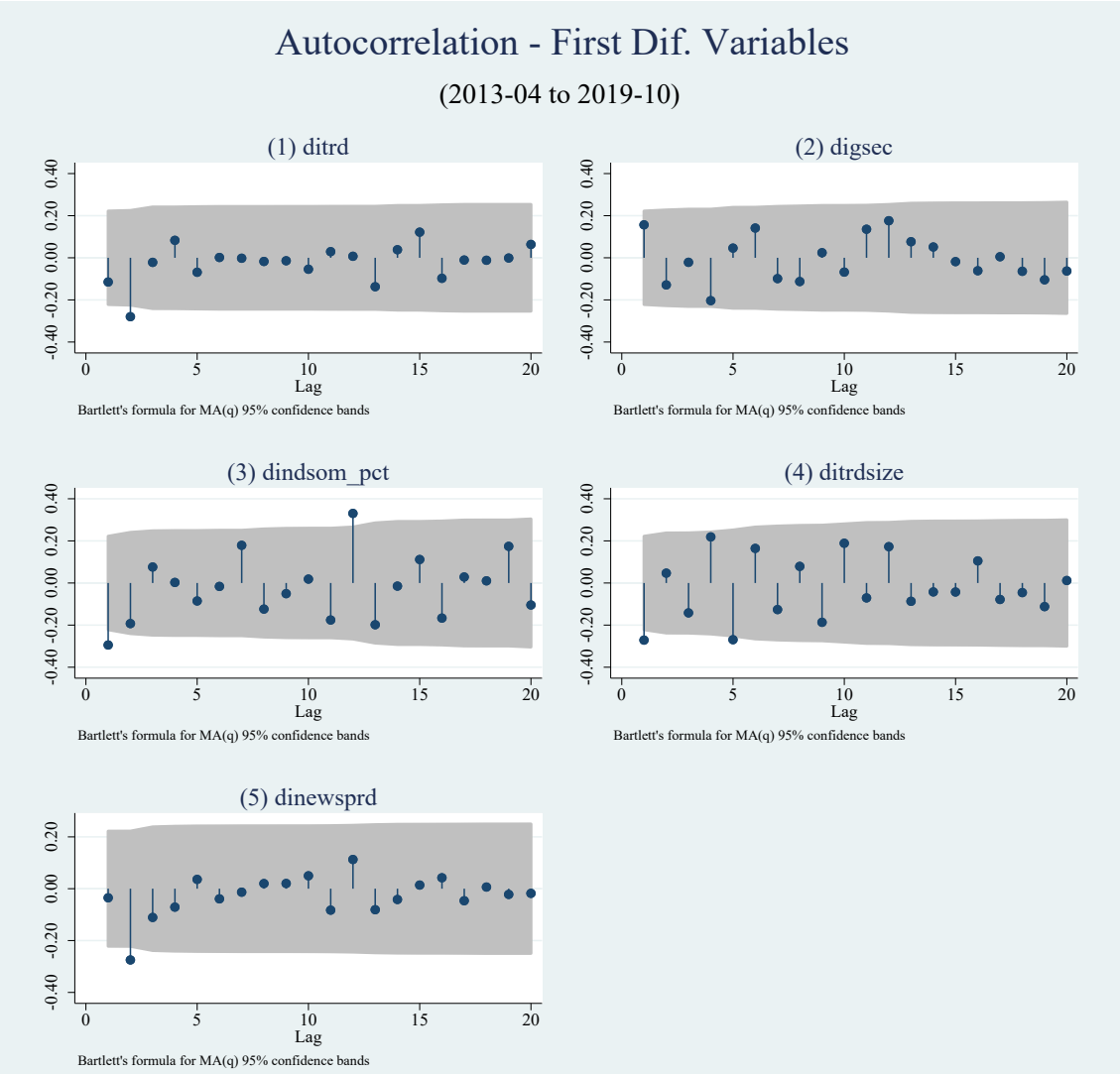


Variable name list (montly averages)
trd: Av Daily Trade volumes
gsec: Av G-sec balance
ndsom_pct: Av Daily NDS-OM Percentages (%)
trdsizes: Av Daily Trade Size
newsprd: Av Bid-Ask Spreads (%)

Prefixes to variable name
d: first-order difference
i: indexed (normalized)

Source: The Author's calculation

Figure 4-11: Autocorrelation Plots – First Dif. Variables for the Second-half Period (2013-04 to 2019-10)



Variable name list (montly averages)

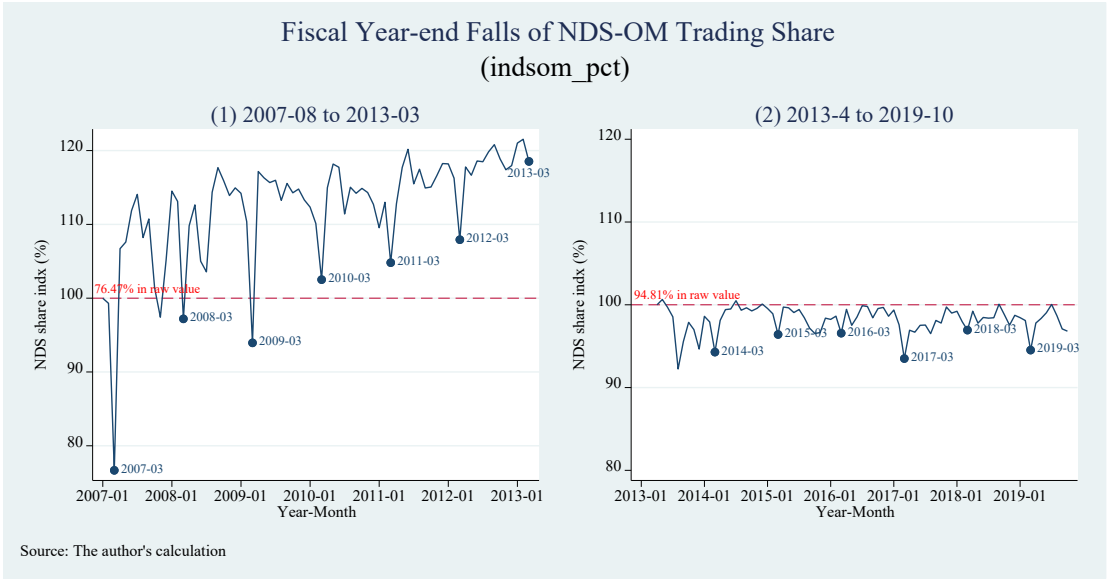
trd:	Av Daily Trade volumes
gsec:	Av G-sec balance
ndsom_pct:	Av Daily NDS-OM Percentages (%)
trdsizes:	Av Daily Trade Size
newsprd:	Av Bid-Ask Spreads (%)

Prefixes to variable name

d:	first-order difference
i:	indexed (normalized)

Source: The Author's calculation

Figure 4-12:Fiscal Year-end Dips of NDSOM Trading Share



Source: The author's calculation

Figure 4-13: Parameter Stability for the First-half Period (2007-01 to 2013-03)

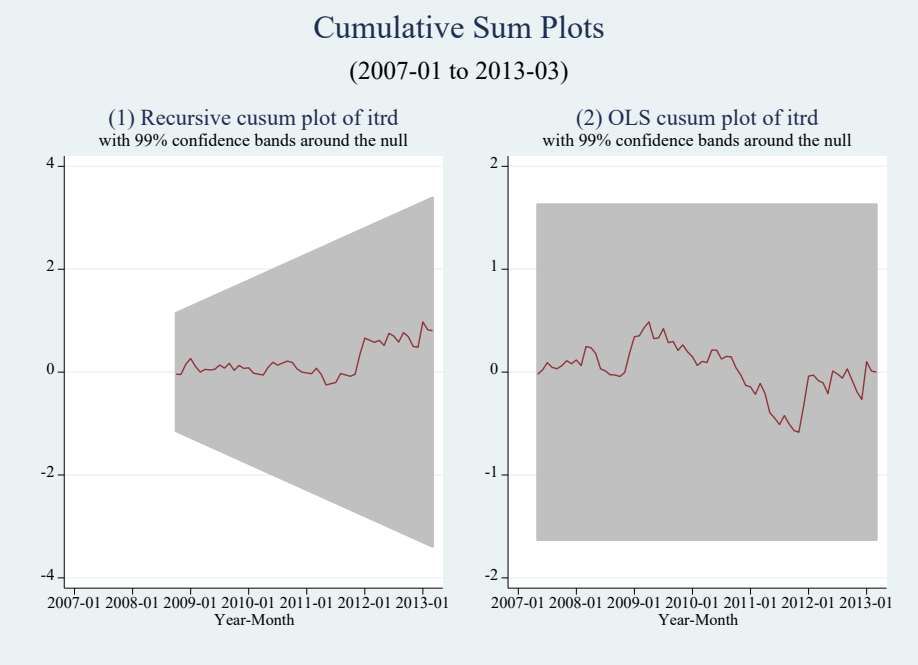


Figure 4-14: Parameter Stability for the Second-half Period (2013-04 to 20193-10)

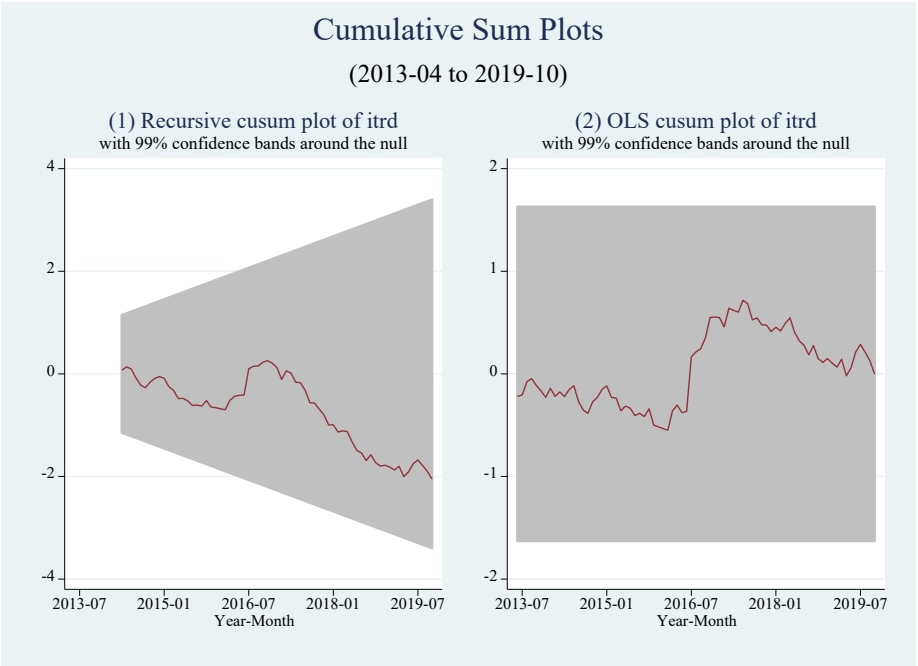
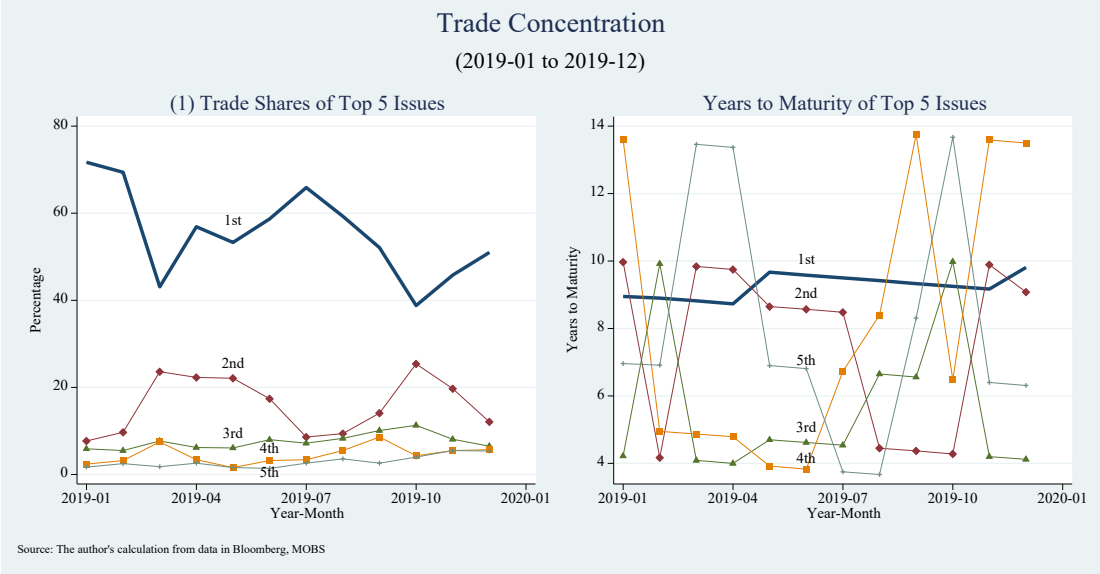


Figure 4-15: Trade Concentration (2019)



Tables

Table 1 Two-Dimensional Policy Framework for Government Securities Market Development

April 2, 2021

Market Development phase		**1**	**2**	**3**	**4**
		Nascent	**Evolving**	**Advanced**	**Highly-Advanced**
Investor base (minor investors)		Mainly captive/state Commercial banks State pension fund State insurance companies (Retail investors) (Corporate investors)	Less captive/state Commercial banks Pension funds Insurance companies (Retail investors) (Corporate investors)	Private sector dominant Yield-seeking Pension funds Life insurance companies Cooperatives Foreign investors Mutual funds Commercial banks	More private sector dominant Competitive performance Pension funds Life insurance companies Cooperatives Foreign investors Mutual funds Hedge funds Commercial banks
Policy principles	Policy Measures	Simple Minimum Low cost	Focused Efficiency-seeking, Local Scalable	Competitive Efficient Beyond the banking sector Equal footing	Sophisticated Internationally competitive Prudential Resilient
	Goals	Visibly fundamental and functional	Essential to a national economy	Influential across the yield curve	Internationally compatible
Functioning Market Component					
Accounting	Policy Measures	Disclosure and governance of institutional investors and intermediaries	Amortization	Mark-to-market (Fair value)	Hedge accounting

Market Development phase		1	2	3	4
		Nascent	**Evolving**	**Advanced**	**Highly-Advanced**
	Goals	Trust building in financial intermediation	Reduced price distortion,	Better performance evaluation of asset management Better risk management Competition for better asset management performance More active trading	Derivatives for risk management
Legal affairs	Policy Measures	Modern business law Modern banking law Public debt law Securities Law Immobilization or depository regulation	Trade failure Trade finality Netting arrangements Dematerialization Code of conduct	Payment system law Novation Securities lending Liquidation of collateral and pledged assets Master repo agreement Enhanced prudential supervision and regulation	International harmonization Jurisdictional (re)alignment Legal and jurisdictional coordination regulators
	Goals	Legal basis for debt securities issuance and trading	Certainty and efficiency of trading	International comparability, Legal basis for trading efficiency, settlement certainty, and risk management Enhanced resilience to shocks	International comparability and connectivity
Primary market	Policy Measures	Preannounced auctions Non-competitive bidding Designated/prequalified bidders Treasury bills Short-term maturities	Issue calendar Reopening or buy-back or switching Tap issuance Bidding open to the public Short- to medium-term maturities	Larger issue amounts Syndicate underwriting Long-term maturities Treasury bills for sterilization	Product innovation (like STRIPS)
	Goals	Introduction of market-based public finance	Lower debt cost by pooling liquidity Lower secondary market prices by consolidating issues Broadening of the investor base	Adaptation to institutional investors Liquidity enhancement Extending the benchmark yield curve	A more reliable yield curve (a zero-coupon yield curve)

Market Development phase		1	2	3	4
		Nascent	**Evolving**	**Advanced**	**Highly-Advanced**
Debt and cash management*	Policy Measures	Cleanup of public or quasi-public arrears Public debt issuance legislation DM office Timely & accurate debt record keeping The separation between front- and back-office activities	Increase in domestic borrowing DM strategy and reporting Consolidation of DM functions Sensible balancing or separation between DM and monetary policy operation (e.g., agency agreement) Partial risk management Sovereign credit rating	Treasury single account Cash flow forecasting Integrated debt recording system with the rest of the public financial management system Middle office (integrated sovereign risk management, etc.)	Assets and liabilities management framework (integrated approach)
	Goals	Explicit authorization to borrow Clear delegation of responsibilities Confidence building in public finance Timely debt service	Mitigation of the "original sin." Reduced refinance or liquidity risks Enhanced accountability of public debt Transparency	Better controlled refinance or liquidity risks	Increased natural hedging of the state's balance sheet
Secondary market	Policy Measures	Negotiated (dealers' "Club") market Telephone voice trading	Screen-based electronic trading platform Call auction or continuous order-driven Market convention Market surveillance	Electronic OTC market (quote-driven) Continuous trading Partial PD market making Market transparency rules Interdealer brokers	Full-scale PD market-making Connectivity Interdealer brokers
	Goals	Occasional trading	Trade transparency Periodic/regular price discovery Centralized marketplace	Liquid trading Extend price discovery to the medium- and long-term segments	Continuous price discovery across the yield curve High-volume trading
Monetary policy framework**		Reliance on rules-based instruments	Introducing money market instruments	Increasing open market operations	Full reliance on money market operations
Money market	Policy Measures	Treasury bills Call market Reserve averaging	Standing facilities (Central bank repos) Interest rate corridor Bank repos Sporadic open market repos	Repos among financial and non-financial institutions (open repo market) Commercial papers	Forward-rate agreements

Market Development phase		1	2	3	4
		Nascent	**Evolving**	**Advanced**	**Highly-Advanced**
	Goals	Reduced volatility of money market rates	Reduced volatility of money market rates Even distribution of fund liquidity Anchoring the yield curve at the short end Introduction of market-based monetary operations	Lower and more stable inventory holding costs for non-bank intermediaries Facilitating a shift from direct instruments to indirect ones	Enhanced hedging function
Derivatives or futures	Policy Measures			Interest rate swaps	Interest futures and options Currency futures and options
	Goals			Interest rate hedging	Higher price discovery and liquidity Reinforced price discovery (yield curve)
Clearing and settlement	Policy Measures	Book-entry CSD	Dematerialization DVP Rolling settlement Multiple-net settlement SWIFT Automation	Integration of payment and securities settlement systems RTGS Central bank money STP	CCP Link to international CSDs Special collateral repos
	Goals	No physical delivery Ownership management	Enhanced Backoffice efficiency Closer market monitoring	Systemic risk reduction	Globalization

Source: The Author

Notes:

* Policy measures for debt management in this Table are those for domestic government debt market development. Emerging economies often resort to external debt before or while their domestic government debt markets develop. Their external debt issuance may require the debt issuing economies to put in place more advanced debt management systems in earlier stages than their domestic debt does.

** Based on the author's interpretation of Laurens, J. Bernard.2005. Monetary policy implementation at different stages of market development. IMF Occasional paper No. 244. Washington, D.C.: International Monetary Fund, 2005. Available at http://www.imf.org/external/pubs/nft/op/244/op244.pdf

(1) A country's market may shift from a development phase to another as its economy goes through a major structural change (inter-phase transition), while most market development likely occurs in a single development phase (intra-phase market improvement).

(2) Listed policy measures are, in principle, new policy measures that should be considered in a particular development phase. The four phases and their policy measures and goals are ballpark guidelines. They should be flexibly applied in the local context. A country's market may be implementing some policy measures that the two-dimensional Table specifies for the next or previous phase.
(3) The Table does not base its development phase classification on numerical parameters. A market's development phase can be determined by comparing its policy measures and institutional settings horizontally or vertically.
(4) Countries can have different developmental goals. Every economy may not always want to advance to higher market developmental stages.
(5) The pace of policy implementation may vary depending on actual market development and unfolding circumstances.
(6) Some policy measures listed in a development phase may conflict.
CCP = central counterparty; CSD = central securities depository; DM = debt management; DVP = delivery vs. payment; OTC = over-the-counter (market); PD = primary dealer; RTGS = real-time gross settlement; STP = straight-through processing; STRIPS =Separate Trading of Registered Interest and Principal of Securities; SWIFT =Society for Worldwide Interbank Financial Telecommunication**.**

Table 2: A Typical Set of Primary Dealers' Obligations

	Primary Market	Secondary Market
Roles	Facilitating Issuance	Market liquidity
Functions	Distribution	Market making
Obligations	Auction participation /Underwriting	Trading volume/value Continuous firm bid-ask quoting
Expected benefits	Low-cost, stable, and low-risk public financing	Price discovery (Financial efficiency) Monetary policy operations

Source: The Author

Table 3: PD Interviews & Surveys Statistics

	Licensed	Interviewed	Answered to survey
PDs	21	17	10
Standalone	7	5	3
Domestic	4	3	2
Foreign	3	2	1
Banks	14	12	7
Domestic	8	8	6
Public	3	3	3
Private	5	5	3
Foreign	6	4	1

Source: The Author

Table 4: PD Surveys about Market Making – Questions and Aggregated Answers

Survey Questions	Aggregated Answers
(1) Do you calculate the cost of market-making to determine the spread?	Six PDs follow "market trend." Four PDs look to repos or market liquidity.
(2) Do you build up and hold an inventory of bonds for market-making purposes?	Seven PDs hold an inventory. By contrast, two PDs deny holding any inventory and instead rely on the repo market.
(3) If you take into account the inventory holding costs, do you include: **• Interest expenses (funding cost) of the inventory** **• Market risk costs of the inventory**	Five PDs take into account funding costs and market risk. Two foreign PDs look to repo rates.
(4) When the market volatility increases, what do you do? **• Widen the spread** **• Withdraw your orders from the market, or** **• Others.**	Five PDs withdraw their quotes. Four PDs widen their quotes.
How often do you withdraw your offers?	Two of them frequently (multiple times a day) and another rarely withdraw their quotes.
Do you withdraw your orders for: **• RBI-predetermined benchmark issues,** **• Normally, most liquid issues, or** **• Both?**	Of five PDs withdrawing quotes, three withdraw both RBI-designated benchmark issues and most liquid issues. Two withdraw quotes from most liquid issues only
(5) What is the distribution of trades between interbank and non-interbank customers? **• 90:10** **• 80:20** **• 70:30** **• 60:40** **• Other.**	The ratio of interbank trades ranges from 60 to 95 percent. Active PDs tend to be more interbank-oriented. Public bank PDs tend to have more customer transactions than others.

Source: The Author

Table 5: The Utilities of the NDS-OM

Traders' expressions	**Facilitated Functions**	**Positive Effects**	**Reduced Costs**
"Ease"	Standardized order format	Standardized trade execution, settlement, clearing, depository, and reporting	Order processing costs
	Electronic connectivity (vertically integration)	• Reduced human intermediation • Straight-through processing	
	Shorter execution time	Enhanced trade immediacy	Opportunity costs
	Central counterparty	No fails, no counterparty risk, settlement certainty	Information (credit) search costs Order processing costs Opportunity costs
"Transparency"	Centralized marketplace	Ensured best execution	Information search costs
	Displayed pre-trade information (limited order book)		Dealers' oligopoly rents
	Immediately reported post-trade information	Shorter trading cycle	Opportunity costs

Source: The Author

Table 6: Sources and Time Span of Data

Monthly Averages of Daily Variable Values	Observation Ranges	Sources
Outright trade volume, Outright trade value, and Repo trade volume	From August 2005 through October 2019	Table 11[a] in CCIL (2019a) and its back numbers
Outstanding balances of government securities and state development loans	From April 2006 to through October 2019	Table 5[b] in CCIL (2019a)
Percentages of NDS-OM trading	From August 2005 through October 2019	Table 27[c] in CCIL(2019a) and its issue and back numbers
Bid-ask spreads	From January 2007 through December 2014	Executed prices of all government securities, CCIL database
	From April 2013 through October 2019	Spreads (paisa) of liquid securities in the CCIL's Market Liquidity Indicators[d]
Turnover ratios	From April 2013 through October 2019	Calculated from the outstanding balances, outright trade volumes, and outright trade values (also available in the CCIL's Market Liquidity Indicators[d])
Ratios of repos to outright trades	From April 2013 through October 2019	Repos in the CCIL's Market Liquidity Indicators[d]

a Table 11: CCIL SETTLEMENT DETAILS and its equivalent tables before the October 2012 issue
b **Table 5: OUTSTANDING - GOVERNMENT SECURITIES, TREASURY BILLS AND STATE DEVELOPMENT LOANS**
c **Table 27: TRADING PLATFORM ANALYSIS OF OUTRIGHT TRADES** and varying table numbers before the January 2016
d **https://www.ccilIndia.com/Research/Statistics/Pages/MarketLiquidityIndicator.aspx**

Table 7 Summary of Variables

(1) The First-half Period

Variable	Variable Label	Obs	Mean	Std. Dev.	Min	Max
Raw Variables						
trd	Av Daily Trades	75	1,447.11	809.66	383.00	4,689.00
gsec	G-securities Balance (INR bil)	75	18,671.38	5,899.67	10,203.50	30,173.60
ndsom_pct	Av Daily NDS-OM Percentages (%)	75	85.96	5.62	58.63	92.94
trdsize	Trade Value Size	75	0.09	0.01	0.07	0.12
oldsprd	Av Old Bid-Ask Spreads (%)	75	0.24	0.18	0.04	0.72
repo	Av Daily Repos	75	204.48	46.66	113.00	317.00
Normalized Variables						
itrd	Trade Volume indx (%)	75	248.64	139.12	65.81	805.67
igsec	G-securities Balance indx (%)	75	182.99	57.82	100.00	295.72
indsom_pct	NDS share indx (%)	75	112.41	7.35	76.67	121.54
itrdsize	Trade Value Size indx (%)	75	125.61	13.70	100.00	167.81
ioldsprd	Old spread indx (%)	75	151.90	115.95	28.06	463.90
irepo	Repo indx (%)	75	116.85	26.66	64.57	181.14

(2) The Second-half Period

Variable	Variable Label	Obs	Mean	Std. Dev.	Min	Max
Raw Variables						
trd	Av Daily Trades	79	4,004.66	1,235.44	1,936.00	8,647.00
gsec	G-securities Balance (INR bil)	79	44,215.38	7,248.60	30,623.60	57,227.70
ndsom_pct	Av Daily NDS-OM Percentages (%)	79	93.11	1.52	87.46	95.42
trdsize	Trade Value Size	79	0.12	0.01	0.10	0.15
newsprd	New Bid-Ask Spread (%)	79	0.03	0.03	0.01	0.18
Normalized Variables						
itrd	Trade Volume indx (%)	79	82.81	25.55	40.03	178.80
igsec	G-securities Balance indx (%)	79	144.38	23.67	100.00	186.87
indsom_pct	NDS share indx (%)	79	98.20	1.60	92.25	100.64
itrdsize	Trade Value Size indx (%)	79	98.77	10.80	81.84	123.95
inewsprd	new spread indx (%)	79	85.51	67.16	26.05	438.96

Source: The Author's calculation

Table 8: Correlation Coefficients among Variables

(1) The First-half Period (2007-01 - 2013-03)

	itrd	*igsec*	*indsom_pct*	*itrdsize*	*ioldsprd*	*irepo*
itrd	1					
igsec	0.7798	1				
indsom_pct	0.6621	0.5881	1			
itrdsize	0.4196	0.3352	0.2008	1		
ioldsprd	-0.2083	-0.3947	-0.0134	0.0575	1	
irepo	0.6615	0.6926	0.361	0.5126	-0.2851	1

(2) The Second-half Period (2013-04 - 2019-10)

	itrd	*igsec*	*indsom_pct*	*itrdsize*	*inewsprd*	*irepo*
itrd	1					
igsec	0.0638	1				
indsom_pct	0.5592	-0.0089	1			
itrdsize	0.3881	0.6401	0.0145	1		
inewsprd	-0.3578	-0.2566	-0.428	-0.2194	1	
irepo	0.0742	0.9545	0.0394	0.6324	-0.2174	1

Source: The Author's calculation

Table 9: Durbin's alternative test for Autocorrelation

(1) The First-half Period (2007-01 - 2013-03)

		lags(p)	chi^2	df	Prob>chi^2	Autocorrelation
Level	*itrd*	1	17.500	1	0.0000	Present
	igsec	1	1028.693	1	0.0000	Present
	indsom_pct	1	3.383	1	0.0659	Not present
	irepo	1	97.241	1	0.0000	Present
	itrdsize	1	35.748	1	0.0000	Present
	ioldsprd	1	71.556	1	0.0000	Present
First difference	*d.itrd*	1	2.342	1	0.1259	Not present
	d.igsec	1	3.234	1	0.0721	Not present
	d.indsom_pct	1	9.051	1	0.0026	Present
	d.irepo	1	4.568	1	0.0326	Present
	d.itrdsd.ize	1	10.289	1	0.0013	Present
	d.ioldsprd	1	4.857	1	0.0275	Present

(2) The Second-half Period (2013-04 - 2019-10)

		lags(p)	chi^2	df	Prob>chi^2	Autocorrelation
Level	*itrd*	1	47.542	1	0.0000	Present
	igsec	1	250.153	1	0.0000	Present
	indsom_pct	1	11.532	1	0.0007	Present
	itrdsize	1	75.380	1	0.0000	Present
	inewsprd	1	57.643	1	0.0000	Present
First difference	*d.itrd*	1	1.003	1	0.3165	Not present
	d.igsec	1	1.857	1	0.1730	Not present
	d.indsom_pct	1	7.132	1	0.0076	Present
	d.itrdsd.ize	1	6.676	1	0.0098	Present
	d.inewsprd	1	0.092	1	0.7612	Not present

Source: The Author's calculation

Table 10: varsoc for Optimal Lag Order Selection

(1L) The First-half Period (2007-01 - 2013-03) - Level

Selected Lag Order	***itrd* 4**		igsec **3**		***indsom_pct* 1**		***irepo* 1**		***itrdsize* 1**		***inoldsprd* 1**	
maxlag	AIC	SBIC	AIC	SBIC	AIC	SBIC	AIC	SBIC	AIC	SBIC	AIC	SBIC
2	1	1	2	2	1	1	2	1	2	1	1	1
3	3	3	3	3	1	1	2	1	2	1	1	1
4	4	4	3	3	1	1	2	1	2	1	1	1
5	4	4	3	3	1	1	2	1	2	1	1	1
6	6	4	3	3	1	1	1	1	1	1	1	1
7	6	4	3	3	7	1	1	1	2	1	1	1
8	6	4	3	3	8	1	2	1	2	1	1	1

(1F) The First-half Period (2007-01 - 2013-03) - First Difference

Selected Lag Order	***ditrd* 3**		***digsec* 2**		***dindsom_pct* 3**		***direpo* 0**		***ditrdsize* 1**		***dioldsprd* 1**	
maxlag	AIC	SBIC	AIC	SBIC	AIC	SBIC	AIC	SBIC	AIC	SBIC	AIC	SBIC
2	2	2	2	2	2	2	1	1	2	1	2	1
3	3	3	2	2	3	3	1	0	2	1	2	1
4	3	3	2	2	3	3	1	0	2	1	2	1
5	5	3	2	2	3	2	1	0	2	1	2	1
6	3	3	2	2	6	3	1	0	2	1	2	1
7	3	3	2	2	7	7	1	0	2	1	2	1
8	3	3	2	2	7	7	1	0	2	1	2	1

(2L) The Second-half Period (2013-04 - 2019-10) - Level

Selected Lag Order	***itrd* 1**		***igsec* 1**		***indsom_pct* 1**		***itrdsize* 1**		***inewsprd* 1**	
maxlag	AIC	SBIC	AIC	SBIC	AIC	SBIC	AIC	SBIC	AIC	SBIC
2	1	1	1	1	1	1	2	1	1	1
3	1	1	1	1	1	1	2	1	3	1
4	1	1	1	1	1	1	2	1	1	1
5	3	1	5	1	1	1	2	2	1	1
6	3	1	5	1	1	1	2	2	3	3
7	3	1	5	1	1	1	2	2	2	2
8	3	1	5	1	1	1	2	2	3	2

(2F) The Second-half Period (2013-04 - 2019-10) - First Difference

Selected Lag Order	***ditrd* 2**		***digsec* 0**		***dindsom_pct* 2**		***ditrdsize* 1**		***dinewsprd* 0**	
maxlag	AIC	SBIC	AIC	SBIC	AIC	SBIC	AIC	SBIC	AIC	SBIC
2	2	0	0	0	2	2	1	1	2	0
3	2	2	0	0	2	2	1	1	2	0
4	2	2	4	0	2	2	1	1	4	2
5	2	2	0	0	2	2	1	1	5	4
6	2	2	4	0	2	2	1	1	1	1
7	2	2	4	0	2	2	1	1	2	1
8	2	2	4	0	2	2	1	1	2	1

Source: The Author's calculation

Table 11: Optimal Lag Orders

		trd	*gsec*	*ndsom_pct*	*repo*	*trdsize*	*old/newsprd*
First-half	Level	4	3	1	1	1	1
	First dif.	3	2	3	0	1	1
Second-half	Level	1	1	1		1	1
	First dif.	2	0	2		1	0

Source: The Author's calculation

Table 12: DF-GLS Tests for the first-half period (2007-1 to 2013-3)

(1) Level for the first-half period (2007-1 to 2013-3)

(1-1) Lag order by the Schwert criterion

variable	*itrd*		*igsec*		*indsom_pct*		*irepo*		*itrdsize*		*ioldsprd*	
lag order	DF-GLS	cv 5%	DF-GLS	cv 5%	DF-GLS	cv 5%	DF-GLS	cv 5%	DF-GLS	cv 5%	DF-GLS	cv 5%
11	-1.198	-2.718	-1.241	-2.718	-0.767	-2.718	-1.246	-2.718	-1.765	-2.718	-1.060	-1.993
10	-1.445	-2.761	-1.101	-2.761	-1.530	-2.761	-1.620	-2.761	-1.635	-2.761	-1.032	-2.011
9	-1.476	-2.805	-1.271	-2.805	-1.637	-2.805	-1.622	-2.805	-1.786	-2.805	-1.475	-2.030
8	-1.191	-2.849	-1.147	-2.849	-1.543	-2.849	#-2.004	-2.849	-1.519	-2.849	-1.709	-2.051
7	-1.298	-2.892	-1.163	-2.892	-1.582	-2.892	#-2.295	-2.892	-1.535	-2.892	-1.490	-2.072
6	-1.123	-2.934	-1.323	-2.934	-1.906	-2.934	#-2.483	-2.934	-1.895	-2.934	-1.806	-2.094
5	-1.298	-2.975	-1.230	-2.975	#-2.469	-2.975	-1.949	-2.975	-1.824	-2.975	-1.774	-2.115
4	-1.724	-3.013	-1.376	-3.013	#-2.735	-3.013	#-2.268	-3.013	#-2.106	-3.013	#-2.145	-2.136
3	-1.868	-3.048	-1.189	-3.048	#-2.803	-3.048	#-2.550	-3.048	#-2.292	-3.048	-1.890	-2.156
2	#-2.621	-3.079	-1.279	-3.079	#-3.893	-3.079	#-2.087	-3.079	#-2.382	-3.079	-1.937	-2.174
1	#-4.664	-3.107	-0.577	-3.107	#-5.194	-3.107	#-2.092	-3.107	#-2.665	-3.107	#-2.340	-2.191

DF-GLS = DF-GLS tau test statics / cv 5% = critical value at 5%

(1-2) Lag order calculated by varsoc on the *itrd* variable

variable	*itrd*		*igsec*		*indsom_pct*		*irepo*		*itrdsize*		*ioldsprd*	
lag order	DF-GLS	cv 5%	DF-GLS	cv 5%	DF-GLS	cv 5%	DF-GLS	cv 5%	DF-GLS	cv 5%	DF-GLS	cv 5%
4	-1.853	-3.001	-1.295	-3.001	#-3.625	-3.001	#-2.353	-3.001	-1.899	-3.001	#-2.237	-2.121
3	#-2.070	-3.031	-1.166	-3.031	#-3.801	-3.031	#-2.677	-3.031	-1.991	-3.031	-1.983	-2.138
2	#-2.852	-3.059	-1.272	-3.059	#-4.481	-3.059	#-2.289	-3.059	#-2.013	-3.059	#-2.028	-2.155
1	#-4.949	-3.083	-0.585	-3.083	#-5.163	-3.083	#-2.306	-3.083	#-2.399	-3.083	#-2.439	-2.169

DF-GLS = DF-GLS tau test statics / cv 5% = critical value at 5%

(2) First Difference for the first-half period (2007-1 to 2013-3)

(2-1) Lag order by the Schwert criterion

variable	*ditrd*		*digsec*		*dindsom_pct*		*direpo*		*ditrdsdize*		*dioldsprd*	
lag order	DF-GLS	cv 5%	DF-GLS	cv 5%	DF-GLS	cv 5%	DF-GLS	cv 5%	DF-GLS	cv 5%	DF-GLS	cv 5%
11	-1.042	-1.994	#-2.222	-2.715	-1.637	-1.994	#-3.049	-1.994	#-2.169	-1.994	#-2.758	-1.994
10	-1.277	-2.012	#-2.47	-2.758	#-3.002	-2.012	#-3.632	-2.012	#-2.107	-2.012	#-3.521	-2.012
9	-1.231	-2.031	#-2.852	-2.803	#-2.183	-2.031	#-3.304	-2.031	#-2.497	-2.031	#-4.239	-2.031
8	-1.412	-2.052	#-2.562	-2.848	#-2.454	-2.052	#-3.664	-2.052	#-2.482	-2.052	#-3.332	-2.052
7	-1.917	-2.074	#-2.942	-2.892	#-3.039	-2.074	#-3.458	-2.074	#-3.642	-2.074	#-3.143	-2.074
6	#-2.193	-2.096	#-3.014	-2.935	#-4.118	-2.096	#-3.300	-2.096	#-4.327	-2.096	#-4.076	-2.096
5	#-3.384	-2.117	#-2.807	-2.976	#-4.529	-2.117	#-3.311	-2.117	#-3.777	-2.117	#-3.766	-2.117
4	#-4.174	-2.139	#-3.063	-3.015	#-4.416	-2.139	#-4.271	-2.139	#-5.054	-2.139	#-4.387	-2.139
3	#-4.893	-2.159	#-2.913	-3.050	#-5.417	-2.159	#-4.077	-2.159	#-4.968	-2.159	#-4.073	-2.159
2	#-7.187	-2.178	#-3.306	-3.083	#-7.972	-2.178	#-4.026	-2.178	#-5.562	-2.178	#-5.613	-2.178
1	#-9.243	-2.194	#-3.322	-3.110	#-9.304	-2.194	#-6.289	-2.194	#-7.558	-2.194	#-7.58	-2.194

DF-GLS = DF-GLS mu test statics / cv 5% = critical value at 5%

(2-2) Lag order calculated by varsoc on the *itrd* variable

variable	*ditrd*		*digsec*		*dindsom_pct*		*direpo*		*ditrdsdize*		*dioldsprd*	
lag order	DF-GLS	cv 5%	DF-GLS	cv 5%	DF-GLS	cv 5%	DF-GLS	cv 5%	DF-GLS	cv 5%	DF-GLS	cv 5%
3	#-5.133	-2.138	#-3.131	-3.031	#-5.915	-2.138	#-4.643	-2.138	#-5.027	-2.138	#-4.355	-2.138
2	#-7.303	-2.155	#-3.499	-3.059	#-7.498	-2.155	#-4.602	-2.155	#-5.924	-2.155	#-5.950	-2.155
1	#-9.443	-2.169	#-3.497	-3.083	#-8.875	-2.169	#-6.710	-2.169	#-8.120	-2.169	#-8.021	-2.169

DF-GLS = DF-GLS mu test statics / cv 5% = critical value at 5%

Reject Ho (unit root)
Source: The Author's calculation

Table 13: DF-GLS Tests for the second-half period (2013-4 to 2019-10)

(1) Level for the second-half period (2013-4 to 2019-10)

(1-1) Lag order by the Schwert criterion

variable	*itrd*		*igsec*		*indsom_pct*		*itrdsize*		*ioldsprd*	
lag order	DF-GLS	cv 5%	DF-GLS	cv 5%	DF-GLS	cv 5%	DF-GLS	cv 5%	DF-GLS	cv 5%
11	#-2.243	-1.991	-1.313	-2.731	-1.593	-1.991	-1.621	-1.991	-1.435	-1.991
10	#-2.225	-2.009	-1.061	-2.772	#-2.257	-2.009	-1.583	-2.009	-1.519	-2.009
9	#-2.474	-2.027	-1.151	-2.813	#-2.485	-2.027	-1.288	-2.027	-1.433	-2.027
8	#-2.455	-2.047	-1.050	-2.854	#-2.732	-2.047	-1.504	-2.047	-1.415	-2.047
7	#-2.626	-2.068	-1.203	-2.894	#-2.805	-2.068	-1.544	-2.068	-1.429	-2.068
6	#-2.510	-2.088	-1.343	-2.933	#-2.648	-2.088	-1.733	-2.088	-1.447	-2.088
5	#-2.507	-2.108	-1.265	-2.971	#-2.741	-2.108	-1.550	-2.108	-1.469	-2.108
4	#-2.649	-2.127	-1.164	-3.006	#-2.901	-2.127	-1.790	-2.127	-1.568	-2.127
3	#-2.791	-2.146	-1.453	-3.038	#-3.307	-2.146	-1.482	-2.146	-1.757	-2.146
2	#-2.864	-2.163	-1.397	-3.067	#-3.382	-2.163	-1.762	-2.163	-1.867	-2.163
1	#-3.884	-2.178	-1.591	-3.093	#-3.876	-2.178	-1.672	-2.178	#-2.265	-2.178

DF-GLS = DF-GLS mu test statics / cv 5% = critical value at 5%

(1-2) Lag order calculated by varsoc on the *itrd* variable

variable	*itrd*		*igsec*		*indsom_pct*		*itrdsize*		*ioldsprd*	
lag order	DF-GLS	cv 5%	DF-GLS	cv 5%	DF-GLS	cv 5%	DF-GLS	cv 5%	DF-GLS	cv 5%
1	#-3.89	-2.151	-1.905	-3.063	#-3.811	-2.151	-1.491	-2.151	-1.846	-2.151

DF-GLS = DF-GLS mu test statics / cv 5% = critical value at 5%

(2) First Difference for the second-half period (2013-4 to 2019-10)

(2-1) Lag order by the Schwert criterion

variable	*ditrd*		*digsec*		*dindsom_pct*		*ditrdsdize*		*dioldsprd*	
lag order	DF-GLS	cv 5%	DF-GLS	cv 5%	DF-GLS	cv 5%	DF-GLS	cv 5%	DF-GLS	cv 5%
11	-0.343	-1.991	-0.960	-1.991	-1.212	-1.991	-0.876	-1.991	0.113	-1.991
10	-0.352	-2.009	-1.076	-2.009	-1.942	-2.009	-0.822	-2.009	-0.171	-2.009
9	-0.345	-2.028	-1.357	-2.028	-1.669	-2.028	-0.811	-2.028	-0.241	-2.028
8	-0.372	-2.048	-1.438	-2.048	-1.817	-2.048	-0.893	-2.048	-0.479	-2.048
7	-0.443	-2.069	-1.755	-2.069	-1.876	-2.069	-0.918	-2.069	-0.731	-2.069
6	-0.494	-2.089	-1.854	-2.089	#-2.133	-2.089	-1.018	-2.089	-0.818	-2.089
5	-0.648	-2.110	-1.946	-2.110	#-2.926	-2.110	-1.051	-2.110	-0.949	-2.110
4	-0.887	-2.129	#-2.407	-2.129	#-3.528	-2.129	-1.389	-2.129	-1.169	-2.129
3	-1.195	-2.148	#-3.212	-2.148	#-4.508	-2.148	-1.460	-2.148	-1.687	-2.148
2	-1.912	-2.165	#-3.289	-2.165	#-5.074	-2.165	#-2.190	-2.165	#-2.344	-2.165
1	#-3.469	-2.181	#-4.452	-2.181	#-6.873	-2.181	#-2.861	-2.181	#-3.883	-2.181

DF-GLS = DF-GLS mu test statics / cv 5% = critical value at 5%

(2-2) Lag order calculated by varsoc on the *itrd* variable

variable	*ditrd*		*digsec*		*dindsom_pct*		*ditrdsdize*		*dioldsprd*	
lag order	DF-GLS	cv 5%	DF-GLS	cv 5%	DF-GLS	cv 5%	DF-GLS	cv 5%	DF-GLS	cv 5%
2	#-2.317	-2.142	#-3.348	-2.142	#-5.876	-2.142	#-2.706	-2.142	#-5.019	-2.142
1	#-3.879	-2.156	#-4.776	-2.156	#-8.489	-2.156	#-3.514	-2.156	##-6.67	-2.156

DF-GLS = DF-GLS mu test statics / cv 5% = critical value at 5%

Reject Ho (unit root)
Source: The Author's calculation

Table 14: Augmented Dickey-Fuller test for Unit Root

(1) The First-half Period (2007-01 - 2013-03)

Order	Variable	Lag	Option	Z(t) Interporated Dickey- Fuller Test Statistic	1% Critical Value	5% Critical Value	10% Critical Value	MacKinnon approximate p-value for Z(t)	Unit-root presence (Stationary/Non-stationary)
Level	*itrd*	4	trend	-1.581	-4.106	-3.480	-3.168	0.7998	Stationary
	igsec	4	drift	1.277	-2.386	-1.669	-1.295	0.8969	Stationary
	indsom_pct	4	trend	-5.464	-4.106	-3.480	-3.168	0.0000	Non-stationary
	irepo	4	trend	-2.358	-4.106	-3.480	-3.168	0.4021	Stationary
	itrdsize	4	trend	-2.212	-4.106	-3.480	-3.168	0.4832	Stationary
	ioldsprd	4	trend	-2.366	-3.552	-2.914	-2.592	0.1517	Stationary
First difference	*d.itrd*	3	noconstant	-6.035	-2.612	-1.950	-1.610		Stationary
	d.igsec	3		-2.900	-3.552	-2.914	-2.592	0.0453	Stationary
	d.indsom_pct	3	noconstant	-6.390	-2.612	-1.950	-1.610		Stationary
	d.irepo	3	noconstant	-4.564	-2.612	-1.950	-1.610		Stationary
	d.itrdsd.ize	3	noconstant	-4.917	-2.612	-1.950	-1.610		Stationary
	d.ioldsprd	3	noconstant	-4.359	-2.612	-1.950	-1.610		Stationary

(2) The Second-half Period (2013-04 - 2019-10)

Order	Variable	Lag	Option	Z(t) Interpolated Dickey- Fuller Test Statistic	1% Critical Value	5% Critical Value	10% Critical Value	MacKinnon approximate p-value for Z(t)	Unit-root presence (Stationary/Non-stationary)
Level	*itrd*	1		-4.378	-3.542	-2.908	-2.589	0.0003	Stationary
	igsec	1	drift	-0.371	-2.378	-1.666	-1.293	0.3559	Non-stationary
	indsom_pct	1		-5.225	-3.542	-2.908	-2.589	0.0000	Stationary
	itrdsize	1		-1.436	-3.542	-2.908	-2.589	0.5649	Non-stationary
	inewsprd	1		-4.043	-3.542	-2.908	-2.589	0.0012	Stationary
First difference	*ditrd*	2		-6.653	-3.545	-2.910	-2.590	0.0000	Stationary
	digsec	2		-5.003	-3.545	-2.910	-2.590	0.0000	Stationary
	dindsom_pct	2		-6.958	-3.545	-2.910	-2.500	0.0000	Stationary
	ditrdsdize	2		-6.364	-3.545	-2.910	-2.590	0.0000	Stationary
	dinewsprd	2		-6.927	-3.545	-2.910	-2.590	0.0000	Stationary

Source: The Author's calculation

Table 15: HEGY test for Seasonal Unit Root

(1) The First-half Period

tested for		***itrd***		***indsom_pct***	
Deterministic variables :		Seasonal dummies and linear trend (strend)		Seasonal dummies and linear trend (strend)	
Lags tested:		12		12	
	Cycles per year	Stat	5% critical	Stat	5% critical
t[0]		-0.652	-2.991	-1.125	-2.985
t[π]	6	-1.558	-2.480	-1.905	-2.474
F[π/6]	1	3.855	5.154	2.484	5.135
F[π/3]	2	2.373	5.154	4.997	5.135
F[π/2]	3	4.247	5.154	1.666	5.135
F[2*π/3]	4	4.278	5.154	3.736	5.135
F[5*π/6]	5	1.763	5.154	3.033	5.135
F[All seas]		#5.282	4.507	#7.113	4.510
F[All]		#4.945	4.818	#7.989	4.824

Reject Ho (seasonal unit root)

(2) The Second-half Period

tested for		***itrd***		***indsom_pct***	
Deterministic variables :		Seasonal dummies		Seasonal dummies	
Lags tested:		12		12	
	Cycles per year	Stat	5% critical	Stat	5% critical
t[0]		-2.294	-2.505	#-3.594	-2.505
t[π]	6	-2.452	-2.520	-1.994	-2.520
F[π/6]	1	4.701	5.273	4.833	5.273
F[π/3]	2	3.526	5.273	5.247	5.273
F[π/2]	3	5.143	5.273	#11.441	5.273
F[2*π/3]	4	5.092	5.273	#10.270	5.273
F[5*π/6]	5	4.912	5.273	#6.794	5.273
F[All seas]		#16.977	4.533	#25.656	4.533
F[All]		#15.944	4.546	#24.994	4.546

Reject Ho (seasonal unit root)

Source: The Author's calculation

Table 16: Bounds testing for cointegration) and Postestimation Tests

(1) The First-half Period (2007-01 - 2013-03)

Lag order combination	Bounds testing for cointegration (estat ectest)		Durbin-Watson test for autocorrelation (estat dwatson)	Breusch–Godfrey test for autocorrelation (estat bgodfrey, lags(1))	White's test for homoskedasticity (estat imtest, white)
	F	t	Normal 1.5 - 2.5	Ho: No autocorrelation	Ho: homoskedasity
	Reject Ho (no level relationship) at				
2 1 0 0 0 0	10%, 5%, 1%	10%, 5%, 1%	1.9291	0.9694	#0.0201
2 1 1 1 1 1	**10%, 5%, 1%**	**10%, 5%, 1%**	**1.9131**	**0.8772**	**0.4449**
3 3 1 1 1 1	10%, 5%, 1%	10% , 5%	1.9801	0.8581	0.4445
4 3 1 1 1 1	10%	Nil.	1.9271	0.0847	0.4442

Reject Ho; Stata commands are in parentheses.

(2) The Second-half Period (2013-04 - 2019-10)

Lag order combination	Bounds testing for cointegration (estat ectest)		Durbin-Watson test for autocorrelation (estat dwatson)	Breusch–Godfrey test for autocorrelation (estat bgodfrey, lags(1))	White's test for homoskedasticity (estat imtest, white)
	F	t	Normal 1.5 - 2.5	Ho: No autocorrelation	Ho: homoskedasity
	Reject Ho (no level relationship) at				
1 0 0 0 0	10%, 5%, 1%	10%, 5%, 1%	1.5445	#0.0132	0.9287
1 1 0 0 0	10%, 5%, 1%	10%, 5%, 1%	1.5927	#0.0282	0.9845
1 1 0 0 1	10%, 5%, 1%	10%, 5%, 1%	1.5879	#0.0198	0.9702
1 1 0 1 0	**10%, 5%, 1%**	**10%, 5%, 1%**	**1.7479**	**0.1512**	**0.9946**
1 1 1 0 0	10%, 5%	10%, 5%, 1%	1.7715	0.1453	0.9933
1 1 1 1 1	10%, 5%	10%, 5%	1.9131	0.7735	0.9958
2 0 0 0 0	10%, 5%, 1%	10%, 5%, 1%	#1.48172	#0.0022	0.7640
2 1 1 1 1	10%	10%	1.9247	0.9608	0.8362

Reject Ho; Stata commands are in parentheses.
Source: The Author's calculation

Table 17: Stata output - Cointegration Relationship of itrd and independent variables for The First-half Period (2007-01 - 2013-03)

The First-half Period (2007-01 - 2013-03)

ARDL(2,1,1,1,1,1) regression

Sample: 2007-03 - 2013-03				Number of obs	=	73
				R-squared	=	**0.5107**
				Adj R-squared	=	0.4128
Log likelihood = -410.93335				Root MSE	=	74.3172

D.*itrd*	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
ADJ						
itrd						
L1.	-0.963828	0.1596048	-6.04	0.000	-1.283085	-0.64457
LR						
igsec	1.238424	0.3184949	3.89	0.000	0.6013392	1.875508
indsom_pct	4.71427	2.321337	2.03	0.047	0.070905	9.357634
irepo	0.9855633	0.6519742	1.51	0.136	-0.3185794	2.289706
itrdsize	1.90578	1.046627	1.82	0.074	-0.1877863	3.999347
ioldsprd	0.0476454	0.1083383	0.44	0.662	-0.1690634	0.264354
SR						
itrd						
LD.	0.2718715	0.12608	2.16	0.035	0.0196739	0.524069
igsec						
D1.	-9.161366	6.217188	-1.47	0.146	-21.59759	3.274862
indsom_pct						
D1.	0.5674625	1.729826	0.33	0.744	-2.892704	4.027629
irepo						
D1.	0.2449174	0.7173015	0.34	0.734	-1.189899	1.679734
itrdsize						
D1.	-0.744683	0.9562347	-0.78	0.439	-2.657437	1.168071
ioldsprd						
D1.	-0.0049948	0.1183265	-0.04	0.966	-0.2416831	0.231694
_cons	-817.1547	252.2628	-3.24	0.002	-1321.755	-312.554

Source: The Author's calculation

Table 18: Stata output - Cointegration Relationship of itrd and independent variables for The Second-half Period (2013-04 - 2019-10)

The Second-half Period (2013-04 - 2019-10)

ARDL(1,1,0,1,0) regression

Sample: 2013-05 - 2019-10	Number of obs	=	78
	R-squared	=	**0.4876**
	Adj R-squared	=	0.4363
Log likelihood = -325.95736	Root MSE	=	16.6783

D.*itrd*	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
ADJ						
itrd						
L1.	-0.6381263	0.095634	-6.67	0.000	-0.8288622	-0.44739
LR						
igsec	-0.3353774	0.1787872	-1.88	0.065	-0.6919573	0.021202
indsom_pct	10.81974	2.306342	4.69	0.000	6.219886	15.4196
itrdsize	1.168602	0.4117613	2.84	0.006	0.3473701	1.989834
inewsprd	-0.0286854	0.0512199	-0.56	0.577	-0.1308402	0.07347
SR						
igsec						
D1.	-2.892274	2.199252	-1.32	0.193	-7.278543	1.493996
itrdsize						
D1.	0.5225009	0.3435998	1.52	0.133	-0.1627873	1.207789
_cons	-663.3685	142.0962	-4.67	0.000	-946.7704	-379.967

Source: The Author's calculation

Table 19: R-squared and Postestimation Tests with Variables Excluded

Lag order combination*	Bounds testing for cointegration (estat ectest) F Reject Ho (no level relationship) at	t	Durbin-Watson test for autocorrelation (estat dwatson) Normal 1.5 -2.5	Breusch–Godfrey test for autocorrelation (estat bgodfrey, lags(1)) Ho: No autocorrelation	White's test for homoskedasticity (estat imtest, white) Ho: homoskedasity	R-squared	Ho: var = 0 *indsom_pct*	 *irepo*
(1) ARDL/EC model controlling for *igsec* for the First-half Period (2007-01 - 2013-03)								
1 0 0 0 0	10%, 5%, 1%	10%, 5%, 1%	1.965487	0.8438	0.0936	**0.4022**	#0.000	#0.023
1 1 0 0 0	10%, 5%	10%, 5%, 1%	1.980802	0.8762	0.3032	0.4024	#0.000	#0.027
1 1 1 0 0	10%, 5%	10%, 5%, 1%	1.972868	0.7909	0.1520	0.4027	#0.000	#0.038
1 1 1 1 0	10%, 5%	10%, 5%, 1%	1.925314	0.4517	0.1804	0.4083	#0.000	0.063
1 1 1 1 1	10%, 5%	10%, 5%	1.922488	0.4358	0.2543	0.4128	#0.000	0.068
2 0 0 0 0	10%, 5%, 1%	10%, 5%, 1%	1.964340	0.8041	0.0075	0.4058	#0.000	#0.018
2 1 1 0 0	10%, 5%	10%, 5%	1.959265	0.5055	0.0658	0.4065	#0.000	#0.028
2 1 1 1 0	10%, 5%	10%, 5%	1.910631	0.5679	0.1678	0.4132	#0.000	#0.049
2 1 1 1 1	10%, 5%	10%, 5%	1.904224	0.4511	0.4512	0.4171	#0.000	0.054
(2) ARDL/EC model controlling for *igsec* and *indsom_pct* for the First-half Period (2007-01 - 2013-03)								
1 0 0 0	10%, 5%, 1%	10%, 5%	1.964616	0.8341	0.4852	**0.1814**	Excluded	#0.015
1 1 0 0	10%	10%, 5%	1.980802	0.8762	0.3032	0.1839	Excluded	#0.016
1 1 1 0	10%	10%, 5%	1.899729	0.4570	0.0873	0.2132	Excluded	0.051
1 1 1 1	10%	10%, 5%	1.900370	0.4606	0.1283	0.2137	Excluded	0.053
2 0 0 0	10%	10%	1.964340	0.8041	#0.0075	0.1894	Excluded	#0.008
2 1 0 0	None	10%	1.988918	0.9343	#0.0183	0.1934	Excluded	#0.007
2 1 1 0	None	10%	1.946091	0.3714	#0.0266	0.2214	Excluded	#0.025
2 1 1 1	None	10%	1.945987	0.3681	0.0955	0.2217	Excluded	0.488

* In the order of *itrd, indsom_pct, irepo, itrdsize,* and i*oldsprd* for (1); and *itrd, irepo, itrdsize,* and *ioldsprd* for (2)
# Reject Ho
Source: The Author's calculation

Table 20: R-squared and Postestimation Tests with Variables excluded

Lag order combination*	Bounds testing for cointegration (estat ectest) F Reject Ho (no level relationship) at	t Reject Ho (no level relationship) at	Durbin-Watson test for autocorrelation (estat dwatson) Normal 1.5 -2.5	Breusch–Godfrey test for autocorrelation (estat bgodfrey, lags(1)) Ho: No autocorrelation	White's test for homoskedasticity (estat imtest, white) Ho: homoscedasity	R-squared	Ho: var = 0 *indsom_pct*	 *irepo*
(1) ARDL/EC model excluding *igsec* for the Second-half Period (2013-04 - 2019-10)								
1 0 0 0	10%, 5%, 1%	10%, 5%, 1%	1.553040	0.0175	0.7832	**0.4213**	#0.000	#0.008
1 1 0 0	10%, 5%	10%, 5%, 1%	1.801236	0.2873	0.8576	0.4511	#0.022	#0.041
1 1 1 0	10%, 5%	10%, 5%	1.991256	0.7260	0.9733	0.4893	#0.022	0.336
1 1 1 1	10%, 5%	10%, 5%	2.023292	0.5191	0.9601	0.4935	#0.048	0.441
2 0 0 0	10%, 5%, 1%	10%, 5%, 1%	#1.483217	#0.0005	0.8401	0.4230	#0.000	#0.010
2 1 0 0	10%, 5%	10%, 5%	1.725438	#0.024	0.9057	0.4590	0.089	0.067
2 1 1 0	10%, 5%	10%, 5%	1.902557	0.6923	0.9604	0.4879	0.077	0.371
2 1 1 1	10%, 5%	10%, 5%	1.943499	0.9288	0.9321	0.4972	0.190	0.526
1 0 0 0	10%, 5%, 1%	10%, 5%, 1%	1.553040	0.0175	0.7832	0.4213	#0.000	#0.008
(2) ARDL/EC model excluding *igsec* and *indsom_pct* for the Second-half Period (2013-04 - 2019-10)								
1 0 0	10%, 5%, 1%	10%, 5%, 1%	1.774259	0.2959	0.6403	**0.2564**	0.135	#0.043
1 1 0	10%, 5%, 1%	10%, 5%, 1%	1.890391	0.7663	0.9461	0.2927	0.549	#0.046
1 1 1	10%, 5%, 1%	10%, 5%, 1%	1.890085	0.7513	0.9623	0.2927	0.555	0.069
2 0 0	10%, 5%, 1%	10%, 5%, 1%	1.766014	#0.0312	0.8115	0.2870	0.117	0.050
2 1 0	10%, 5%, 1%	10%, 5%, 1%	1.867795	0.3191	0.9786	0.3098	0.416	0.055
2 1 1	10%, 5%, 1%	10%, 5%, 1%	1.862177	0.2415	0.8682	0.3112	0.437	0.054
2 2 0	10%, 5%, 1%	10%, 5%, 1%	1.814740	0.0720	0.9857	0.3184	0.634	0.078
2 2 1	10%, 5%, 1%	10%, 5%, 1%	1.805833	#0.0294	0.8820	0.3206	0.673	0.068

* In the order of *itrd, indsom_pct, itrdsize,* and i*newsprd* for (1); and *itrd, itrdsize,* and *inewsprd* for (2)
# Reject Ho
Source: The Author's calculation

Table 21: Policy Measures in Two-Dimensional Framework and India's Implementation

	1		2	
	Nascent		**Evolving**	
Market Component	**Policy measures in Two-Dimensional Framework**	**Policy measures in India's implementation**	**Policy measures in Two-Dimensional Framework**	**Policy measures in India's implementation**
Accounting	Disclosure and governance of institutional investors and intermediaries		Amortization	
Legal affairs	Modern business law Modern banking law Public debt law Securities Law Immobilization or depository regulation	The Constitution (Articles 202 and 293) The Reserve Bank of India Act (Articles 21(2) and 21A(1)(b)) SEBI Act 1992	Trade failure Trade finality Netting arrangements Dematerialization Code of conduct	The Payment and Settlement Systems (Amendment) Act, 2015 Dematerialization of Government Securities (1998) DVP-III (2004)
Primary market	Preannounced auctions Non-competitive bidding Designated/prequalified bidders Treasury bills Short-term maturities	Auction of government securities and Treasury bills (1992 and 1993) Non-competitive bidding (2009) PDs (1995)	Issue calendar Reopening or buy-back or switching Tap issuance Bidding open to the public Short- to medium-term maturities	Issuance Calendar for Marketable Dated Securities (2015) Buy-Back (2003) Conversion (Switch)(2019)
Debt and cash management*	Cleanup of public or quasi-public arrears Public debt issuance legislation DM office Timely & accurate debt record keeping The separation between front- and back-office activities	Restricted and prohibited ad-hoc T-Bills (1994 and 1997). Commonwealth Debt Recording and Management System (1986)	Increase in domestic borrowing DM strategy and reporting Consolidation of DM functions Sensible balancing or separation between DM and monetary policy operation (e.g., agency agreement) Partial risk management Sovereign credit rating	Fiscal Responsibility and Budget Management Act (FRBM) (2003) requiring the govt to report to the parliament Medium-term debt management strategy (2015)
Secondary market	Negotiated (dealers' "Club") market Telephone voice trading	Securities Trading Corporation of India (STCI) (1994)	Screen-based electronic trading platform Call auction or continuous order-driven Market convention Market surveillance	NDS-OM (2005) The Fixed Income Money Market and Derivatives Association of India (FIMMDA) (1998)
Monetary policy framework**	Reliance on rules-based instruments		Introducing money market instruments	CP (2017)
Money market	Treasury bills Call market Reserve averaging	Auction of T-bills bills (1993)	Standing facilities (Central bank repos) Interest rate corridor Bank repos Sporadic open market repos	Liquidity Adjustment Facility (LAF) (2000) Repos permitted to SGL a/c holders (1997)
Derivatives or futures				
Clearing and settlement	Book-entry CSD	Subsidiary General Ledger at RBI National Securities Depository Ltd (1995) Depositories Ordinance (1995) Depositories Act (1996)	Dematerialization DVP Rolling settlement Multiple-net settlement SWIFT Automation	Dematerialization of Government Securities (1998) A dematerialized form made mandatory for RBI-regulated entities (2003) DVP I (1995), II (2002), III (2004)

Notes: Desirable policy measures were taken from Table 1. India's Implemented policy measures are not exclusive. The years are those in which the measures were initially undertaken.
Source: The Author compiled data from CCIL (2017), Fleming *et al.* (2015), Mohan and Ray (2009), Rajaram and Ghosh (2015), RBI (2019), and the websites of NSDL, CCIL, the Department of Economic Affairs.

References

Abbas, S. M., & Christensen, J. (2007). The Role of Domestic Debt Markets in Economic Growth: An Empirical Investigation for Low-Income Countries and Emerging Markets. *IMF Working Papers*, 07(127), 1. doi:10.5089/9781451866919.001. Available at https://www.imf.org/en/Publications/WP/Issues/2016/12/31/The-Role-of-Domestic-Debt-Markets-in-Economic-Growth-An-Empirical-Investigation-for-Low-20973

Adelegan, O. J., & Radzewicz-Bak, B. (2009). What Determines Bond Market Development in Sub-Saharan Africa? IMF Working Papers, 09(213), 1. doi:10.5089/9781451873603.001. Available at SSRN: http://ssrn.com/abstract=148653135

African Development Bank. (2007). African Fixed Income Guidebook, African Development Bank. Retrieved from: https://www.afdb.org/fileadmin/uploads/afdb/Documents/Publications/2007%20African%20Fixed%20Income%20Guidebook.PDF

African Development Bank. (2010). African fixed income and Derivatives Guidebook, African Development Bank. Retrieved from: https://www.afdb.org/fileadmin/uploads/afdb/Documents/Publications/AfDB-Guidebook-EN-web.pdf

Aguilar, C. (2006). The Development of Latin-American Bond Markets: The Case of Colombia. Research Project. Inter-American Development Bank, Washington, DC.

Akamatsu, N., & Puongsophol, K. (2017). Good Practices in Developing Bond Market: with a focus on government bond market. Association of Southeast Asian Nations Plus Three. Available at https://asianbondsonline.adb.org/documents/abmi_good_practices_developing_bond_market_draft.pdf

Amante, A., Araujo, M., & Jeanneau, S. (2007). The Search for Liquidity in the Brazilian Domestic Government Bond Market. *BIS Quarterly Review* (June): 69–82. Available at http://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.370.5057&rep=rep1&type=pdf

Arif, M. (2007). *Developing Bond Market in Pakistan* (SBP Research Bulletin, Volume 3, Number 1). State Bank of Pakistan. Retrieved. Retrieved from http://www.sbp.org.pk/research/bulletin/2007/vol3/Bond-Market-Pakistan.pdf \

Arvai, Z., & Heenan, G. (2008). A Framework for Developing Secondary Markets for Government Securities. *IMF Working Paper* 08/174, 1–55. Available at SSRN: http://ssrn.com/abstract=126650735

Berensmann, K., Dafe, F., & Volz, U. (2015). Developing local currency bond markets for long-term development financing in Sub-Saharan Africa. *Oxford Review of Economic Policy*, 31(3-4), 350-378. doi:10.1093/oxrep/grv032

BIS. (2002). *The Development of Bond Markets in Emerging Economies* (BIS Papers No. 11). Monetary and Economics Department, Bank for International Settlements. Available at www.bis.org/publ/bppdf/bispap11d.pdf

Blommestein, H., & Horman, G. (2007). Public Debt Management and Bond Markets in Africa. Organisation of Economic Co-operation and Development. Available at http://www.publicdebtnet.org/export/sites/PDM/public/CORE-TOPIC/Government_Debt_Management_and_Bond_Markets_in_Africa_final_5_June_2007_7_.pdf

Castellanos, S. G., & Martínez, L. (2006). *The Development and Challenges Faced by the Mexican Bond Market*. Latin-American and Caribbean Research Network Project on The Development of Latin American Bond Markets. Inter-American Development Bank, Washington, DC.

CCIL (2019a, November). *Rakshitra.* The Clearing Corporation of India, Limited. Available at https://www.ccilindia.com/Research/CCILPublications/Lists/CCILPubRakshitra/Attachments/307/Rakshitra%20November%202019.pdf

CCIL (2019b). *Factbook 2019 Annexure*. The Clearing Corporation of India, Limited. The current issue available at https://www.ccilindia.com/Research/CCILPublications/Lists/lstfactbook/Attachments/35/Complete_FACTBOOK.pdf

Chaumont, G. (2018). Sovereign Debt, Default Risk, and the Liquidity of Government Bonds. Available at https://economics.sas.upenn.edu/system/files/2019-01/ChaumontJMP.pdf

Christensen, C. M. (1997a). Patterns in the evolution of product competition. *European Management Journal*, 15(2), 117-127. https://doi:10.1016/s0263-2373(96)00081-3

Christensen, C. M. (1997b). *The innovator's dilemma: when new technologies cause great firms to fail*. Boston, MA: Harvard Business School Press. ISBN 978-0-87584-585-2.

Claessens, S., Klingebiel, D., & Schmukler, S. L. (2007). Government bonds in domestic and foreign currency: The role of institutional and macroeconomic factors. *Review of International Economics*, 15(2), 370-413. Available at https://onlinelibrary.wiley.com/doi/abs/10.1111/j.1467-9396.2007.00682.x or https://doi.org/10.1111/j.1467-9396.2007.00682.x

Dattels, P. (1995). The Microstructure of Government Securities Markets. IMF Working Paper, WT/95/117. International Monetary Fund. Washington, DC. Available at https://www.elibrary.imf.org/doc/IMF001/07169-9781451853988/07169-9781451853988/Other_formats/Source_PDF/07169-9781455282715.pdf

de Brun, J. E., Gandelman, N., Kamil, H., & Porzecanski, A. C. (2006). The Fixed-Income Market in Uruguay. *Bond Markets in Latin America*. doi:10.7551/mitpress/7710.003.0010 Retrieved from SSRN: http://ssrn.com/abstract=929166.

De La Torre, A., & Schmukler, S. L. (2007). *Emerging Capital Markets and Globalization: The Latin American Experience*, World Bank, Washington, DC

Deuskar, P., & Johnson, T. C. (2016). Central Banks And Dynamics Of Bond Market Liquidity. *CFRAL Working Paper*. Centre for Advanced Financial Research and Learning. Mumbai. Available at http://www.cafral.org.in/sfControl/content/Speech/46201664559PM-Deuskar_Johnson_Paper.pdf

Endo, T. (2020). The primary dealer system in lower-income economies. *Emerging Markets Review*, Volume 45, December, 100715. doi:10.1016/j.ememar.2020.100715

Fleming, M., Sareen, S., & Saggar, S. (2015). Structural Changes In The Indian Government Bond Market. *CFRAL Working Paper*. Centre for Advanced Financial Research and Learning. Mumbai. Available at http://www.cafral.org.in/sfControl/content/Speech/46201623614PM-Fleming_Sareen_Paper_Dec_2015.pdf

Fleming, M., Sareen, S., & Saggar, S. (2016). Trading Activity In The Indian Government Bond Market. *CFRAL Working Paper*. Centre for Advanced Financial Research and Learning. Mumbai. Available at http://www.cafral.org.in/sfControl/content/Speech/71201624534PMFleming_Sareen_Saggar_Paper_Abstract_June_2016.pdf

Grossman, S., & Miller, M. (1988). Liquidity and Market Structure. *The Journal of Finance*, XLIII(3), 618-633. Available at https://onlinelibrary.wiley.com/doi/full/10.1111/j.1540-6261.1988.tb04594.x or https://doi.org/10.1111/j.1540-6261.1988.tb04594.x

Gurowitz, E. (2012) Positioning Products and Services Accurately. Retrieved February 8, 2021, from http://gurowitz.com/2012/12/positioning-products-and-services-accurately/

Hanson, J. A. (2007). The Growth in Government Domestic Debt: Changing Burdens and Risks. *World Bank Policy Research Working Paper* 4348. World Bank, Washington, DC. Available at http://elibrary.worldbank.org/docserver/4348.pdf.

Harris, L. (2003). *Trading and Exchanges: market microstructures for practitioners.* New York: Oxford University Press.

Horton, G. (n.d.) Refining the Windermere Hierarchy. Retrieved February 8, 2021, from http://www.zephram.de/blog/innovationsstrategie/refining-the-windermere-hierarchy/

IMF & World Bank. (2016). Development of local currency bond markets overview of recent developments and key themes prepared for the G20 IFAWG, International Monetary Fund, Washington, DC, Available at http://www.imf.org/external/np/g20/pdf/2016/121416.pdf

IMF & World Bank. (2021). Guidance Note For Developing Government Local Currency Bond Markets. *Analytical Notes No. 2021/001*. Washington, DC: International Monetary Fund, and World Bank. Available at

https://www.imf.org/en/Publications/analytical-notes/Issues/2021/03/17/Guidance-Note-For-Developing-Government-Local-Currency-Bond-Markets-50256

IMF, World Bank, EBRD, & OECD. (2013). Developing Local Currency Bond Markets: A New Diagnostic Framework, Available at http://www.oecd.org/daf/fin/public-debt/Local-Currency-Bond-Markets-Diagnostic-Framework-2013.pdf, or https://www.imf.org/en/Publications/Policy-Papers/Issues/2016/12/31/Local-Currency-Bond-Markets-A-Diagnostic-Framework-PP4811

Jiang, G., & McCauley, R. N. (2004). Asian Local Currency Bond Markets. *BIS Quarterly Review, June 2004: International Banking and Financial Market Developments* (June): 67–79. Bank for International Settlements, Basel, Switzerland.

Kripfganz, S., & Schneider, D.C. (2018). ardl: Estimating autoregressive distributed lag and equilibrium correction models. Proceedings of the 2018 London Stata Conference. Available at http://repec.org/usug2018/uk18_Kripfganz.pdf.

Kumhof, M., & Tanner, E. (2005). Government Debt: A Key Role in Financial Intermediation. *IMF Working Paper* 05/57.

Leal, R. P. C., & Carvalhal-da-Silva, A. L. (2006). The Development of the Brazilian Bond Market. Inter-American Development Bank, Washington, DC. http://www.iadb.org/res/laresnetwork/projects/pr253finaldraft.pdf.

Madhavan, A. (1992). Trading Mechanisms in Securities Markets. *The Journal of Finance, 47*(2), 607-641. doi:10.2307/2329117

Mohan, R. (2004) Decade of Reforms in Government Securities Market in India and the Road Ahead. Keynote Address by Dr. Rakesh Mohan, the then Deputy Governor, Reserve Bank of India at the Annual Conference of FIMMDA jointly organised by Fixed Income Money Market Dealers Association of India (FIMMDA) and Primary Dealers Association of India (PDAI) on March 20, 2004 at Dubai. Available at http://rakeshmohan.com/docs/RBIBulletinNov2004-2.pdf

Mohan, R. (2006) Recent Trends in the Indian Debt Market and Current Initiatives. Available at http://www.rakeshmohan.com/docs/RBIBulletinApril2006-1.pdf and https://rbidocs.rbi.org.in/rdocs/Speeches/DOCs/69400.doc.

Mohan, R., & Ray, P. (2009). Development of the Indian Debt Market. The Stanford Center for International Development Working Paper 410, December. Available at https://siepr.stanford.edu/sites/default/files/publications/410wp.pdf

Mohan, R., & Ray, P. (2017). Indian Financial Sector: Structure, Trends and Turns. *IMF Working Papers* WP/17/7. Available at https://www.imf.org/~/media/Files/Publications/WP/wp1707.ashx

Moitra, S. K. (1983). *Structure and Management of The Gilt-Edged Securities Markets in India.* Corporate Investment Research and Consultancy Bureau. New Delhi

Moore, G. A. (2014). *Crossing the Chasm: Marketing and Selling Disruptive Products to Mainstream Customers* (3rd ed.). New York, NY: Harper Business [Kindle version]

Nath, G. (2013). Liquidity issues in Indian sovereign bond market. MPRA Paper 51633, University Library of Munich, Germany. Available at https://mpra.ub.uni-muenchen.de/51633/

Panizza, Ugo. (2008). Domestic and External Public Debt in Developing Countries. *United Nations Conference on Trade and Development Discussion Paper* No. 188. Retrieved from SSRN: http://ssrn.com/abstract=1147669.

Patil, R.H.(2001). Broadbasing and Deepening the Bond Market in India. Center for Financial Institutions Working Papers 01-32, Wharton School Center for Financial Institutions, University of Pennsylvania. Available at http://d1c25a6gwz7q5e.cloudfront.net/papers/1171.pdf

Rajaram, S., & Ghose, P. (2015). Two Decades of Primary Dealer Operations in India. *Rakhshitra*. May 2015, Clearing Corporation of India, Ltd. Available at https://www.ccilIndia.com/Documents/Rakshitra/2015/May/Article.pdf

RBI. (2013). Negotiated Dealing System (NDS). Available at https://rbidocs.rbi.org.in/rdocs/Publications/PDFs/NDSOM290410.pdf

RBI. (2015) Master Direction – Operational Guidelines for Primary Dealer. Available at https://rbidocs.rbi.org.in/rdocs/notification/PDFs/34MPBA3C2D6A9B114194A38ACD8C4E90BE50.PDF

RBI. (2019). Government Securities Market in India – A Primer. Available at https://rbidocs.rbi.org.in/rdocs/Publications/PDFs/PRI85CEC73A987F41AC89068EE7607A8BEC.PDF

Reddy, Y.V. (2002). Issues and Challenges in the Development of the Debt Market in India. *The Development of Bond Markets in Emerging Economies*, BIS Papers No. 11, June: 117-126. Available at https://www.bis.org/publ/bppdf/bispap11j.pdf

Roger, E. M. (2003). *Diffusion of Innovations*. (5th ed.). New York, NY: Free Press. [Kindle version]

Schinasi, G. J. & Smith, R. T. (1998). Fixed-Income Markets in the United States, Europe, and Japan: Some Lessons for Emerging Markets. IMF Working Paper, WP/98/173. International Monetary Fund. International Monetary Fund. Washington, DC. Available at https://www.imf.org/~/media/Websites/IMF/imported-full-text-pdf/external/pubs/ft/wp/_wp98173.ashx

Shankar, R., & Bose, S. (2008). Auctions of Government Securities in India –An Analysis. *Reserve Bank of India Occasional Paper*, 29(3), Available at https://pdfs.semanticscholar.org/2a15/4a8fac6c6df6f2eae65c312ec35caadef3ba.pdf

Silva, A. (2008). Bond Market Development: Monetary and Financial System Stability Issues. Central Bank of Sri Lanka. http://www.unescap.org/pdd/projects/bondmkt/5_bond_SL_stability.pdf

Smaoui, H., Grandes, M. & Akindele, A. (2017). The Determinants of Bond Market Development: Further Evidence from Emerging and Developed Countries. *Emerging Markets Review*, Elsevier, vol. 32(C), pages 148-167.

Sophastienphong, K., Mu, Y., & Saporito, C. (2008). *South Asian bond markets: Developing long-term finance for growth*. Washington, D.C.: World Bank.

Sundararajan, V., Dattels, P., & Blommenstein, H. J. (1997). *Coordinating Public Debt and Monetary Management*, International Monetary Fund. Available at https://www.elibrary.imf.org/doc/IMF071/01370-9781557755551/01370-9781557755551/Other_formats/Source_PDF/01370-9781455273911.pdf.

Sy, Amadou. (2007). Local Currency Debt Markets in the west African Economic and Monetary Union. *IMF Working Paper* 07/256. International Monetary Fund, Washington, DC.

Szilagyi, P. G., Batten, J. A., & Fetherston, T. A. (2003). Disintermediation and the development of bond markets in emerging Europe. *International Journal of the Economics of Business*, *10*(1), 69-84. Available at SSRN: https://ssrn.com/abstract=463401

Ventzislav, I & Lutz, K. 2005. A Practitioner's Guide to Lag Order Selection For VAR Impulse Response Analysis, Studies in Nonlinear Dynamics & Econometrics, De Gruyter, vol. 9(1), pages 1-36, March. DOI: https://doi.org/10.2202/1558-3708.1219

Warnock, F. E., & Burger, J. D. (2006). Local Currency Bond Markets. Available at SSRN: https://papers.ssrn.com/sol3/papers.cfm?abstract_id=930072 or http://dx.doi.org/10.2139/ssrn.930072

World Bank & IMF. (2001). *Developing Government Bond Markets: A Handbook*. Washington, DC: World Bank and IMF. Available at https://elibrary.worldbank.org/doi/abs/10.1596/0-8213-4955-4

World Bank. (2007a). Managing Public Debt from Diagnostics to Reform Implementation. Washington, DC: World Bank. Available at https://openknowledge.worldbank.org/handle/10986/6658

World Bank. (2007b). Developing the Domestic Government Debt Market: From Diagnostics to Reform Implementation. Washington, DC: World Bank. Available at https://openknowledge.worldbank.org/handle/10986/13865