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INTEGRATION OF INDIA'S FINANCIAL MARKETS ON THE DOMESTIC AND INTERNATIONAL FRONTS: AN EMPIRICAL ANALYSIS OF THE POST-LIBERALISATION PERIOD

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ABSTRACT

Against the backdrop of financial liberalisation, this paper examines India's financial integration, both on the domestic and international fronts. Preliminary analysis of the secondary data shows India's capital market grew significantly during 2001-2007 in terms of the trading value of equities and bonds compared to some sample countries, covering both developed (Germany, Italy, US, UK) and emerging (China, Korea, Brazil) economies. Also, during this phase, empirical evidence reveals high liquidity in the Indian capital market. The increasing gross flow of capital across borders and increasing correlation among different asset returns of major financial markets in the last couple of years provide the premise of interlinkage across different segments of financial markets, domestic as well as international. The Johansen and Juselius cointegration test in a multi-equation framework reveals comovement among the domestic money, capital and foreign exchange markets with strong comovement between the short-term money and foreign exchange markets. A cross-country Johansen and Juselius analysis, in terms of the short-term inter-bank rate, shows convergence of two different clusters of countries, with Canada, Germany, India, and the UK figuring as common members in both. Also, a stochastic time series analysis shows that the Law of One Price (LOOP) holds for Indian call money market rates. The findings on the 91-day Treasury Bill rate and the 10-year government bond yield reveal very weak cross-border cointegration. Broadly, the domestic and international integration of Indian financial markets opens up the possibility of further enquiries into the relationship between the financial sector and the real sector of the economy because McKinnon's complementarity hypothesis holds only in a fragmented and underdeveloped financial economy.

Key Words: Financial Markets, Financial Integration, Long-term and Short-term Capital Movements.

JEL Classification: E44, F36, F21, F32

I. Context of the study

As a consequence of gradual liberalization of India's financial sector India too has become a part of the world-wide integrated financial system. In this context the purpose of this paper is to empirically examine India's financial integration on both the domestic and international fronts. The integration of financial markets across boundaries had been initiated by the capital market integration in developed countries. Also, revolution in Information and Communication Technologies (ICTs) has been playing a crucial role for connecting financial activities across countries. Conventionally, firms depended solely on banks for external financing, but the development of the capital market and the worldwide linkage of the financial sector have opened up an alternative possibility— firms can now raise funds either by issuing equity or bonds, domestically as well as internationally. It suggests that the domestic and international markets are complementary (Gozzi et al., 2009) and that their operational integrity depends on banks' credit lending policy, which again depends mostly on the security value of a firm in the capital market. Also, Gramm Leach Bliley Act of 1999 (GLBA) provides US banks' the right to participate limitlessly in the domestic or cross-border capital markets. In 1999, India too had taken the policy decision to free India's commercial banks to practice universal banking, though not limitlessly.[1] This leads to integration of the whole spectrum of an economy, both its financial and real sectors. Financial integration has become an important policy issue because of its trade-off between positive and negative consequences. It helps in efficient transmission of different monetary policy effects and provides an opportunity to

1 For detail please see Y. V. Reddy (1999)

diversify investment, thereby pooling risk and channelising liquidity across markets. On the contrary, it might lead to the collapse of an entire economy following the downfall of a few financial institutions. In the post-liberalisation era, the worldwide integrated capital market has opened up the possibility of a crisis spreading out from the domestic periphery of the country in which it originates. Any shock in one country might cause the flight of capital from other integrated countries, affecting the asset value of corporate entities and reducing the creditworthiness of firms. As a consequence, banks could lose confidence and become reluctant to lend money, which might create a credit crunch, bring down production and employment, and so on. Besides, some other effects could operate through reduction of the size of the export market and a fall in foreign exchange earnings. The trade-off could be viewed from three major perspectives of interlinkage—one, among domestic financial market segments; two, among financial markets across borders; and three, between the financial sector and the real sector. There might be little doubt about the positive effect of integration among the domestic segments of a financial market as it leads to the operational efficiency of intermediaries through proper allocation of resources, in turn contributing to financial stability (Trichet, 2005). But cross-country financial linkages, newer and newer forms of financial instruments and immense securitisation[2] of debts add to the existing debate on international flow of capital by posing a threat to the stability of financial system. In this context, Keynes (1936) suggested that finance better remain a national concern. In the context of recent US crisis, Krugman (2008) opined that the vastly increased international mobility of financial capital as the single factor responsible for the contagion effect across nations and finally emerging as a broader real sector crisis.

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2 A method by which a loan or group of loans (for example, mortgages, car loans) is converted into a new flow of finance through the issue of bonds, which is granted invariably by a bank and carries acceptable collateral. In short, the instrument resulting from the conversion of bank loans into a marketable security is known as securitisation.

Consequently, the dynamics between the real and financial sectors of the economy has become an issue of debate, as we know McKinnon's complementarity hypothesis (1973) holds only in a fragmented and repressed economy. Recently, vast securitisation of debts and their trade in the secondary market have made the connection between the financial and real sector more complex as it depends on speculation and investors' sentiment. Though theory suggests that integration across financial markets might lead to a "no arbitrage" situation, the contemporary trading of different financial assets (for price differentials in different markets) plays a crucial role to maintain the liquidity of the capital market. People are more prone to invest in securities to earn huge returns in a short period of time, making financial systems more volatile. Hence, it is a very important policy decision to retain a more liquid and integrated financial system without disturbing the stability of its economy.

Before we delve into the detail of the measurement of India's financial integration we discuss the concept and the problem of measurement of financial market integration.

I.1 Financial integration: measurement problems

Financial market integration might be defined as the interlinkage and unimpeded access to different segments of financial markets within and across countries. It might lead to the unification of markets in terms of convergence[3] of risk-adjusted returns on assets of similar maturity across markets. In other words, the principle of law of one price (LOOP) holds in a financially integrated market.[4] Financial market integration

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3 β-convergence and ó-convergence are borrowed from growth theory to measure financial integration. For details, see Baele et al., 2004.

4 Pioneered by Antoine Augustin Cournot (1927) and Alfred Marshall (1930). LOOP mainly says that in the absence of administrative and informational barriers, the risk adjusted returns on identical assets should be comparable across markets. It is the most established and fundamental principle regarding financial integration and is a more general framework when compared with other operational frameworks.

can occur horizontally among domestic financial markets (depends on the efficient and growing participation of intermediaries) or vertically among international financial markets (as a consequence of openness of the capital account and stock market liberalisation) (BIS, 2006). Domestic market integration plays an important role in signalling the interest rate which revolves around a basic reference rate.[5] On the other side, international financial integration makes a financial system more competitive by increasing opportunities to access better investment projects, maintain a proper balance of liquidity across different markets and unify rates of return, which influence international investment decisions and risk sharing (Lane et al., 2003).[6] Financial market integration is expected to provide interesting insights that help understand the transmission of effect from one market to another where rates of return or asset price play a decisive role in influencing saving and investment. Taylor (1995) explains the importance of at least three types of prices—exchange rates, long-term interest rates and short-term interest rates in the framework of financial market prices—to understand the impact of monetary policy changes on real gross domestic product

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5 The reference rate is defined as the price of a short–term, low-risk financial instrument in a competitive and liquid market.

6 A financially integrated economy is a better performer in terms of per capita income and living standards (Kose et al., 2003). It leads to efficient allocation of capital and thereby promotes growth (Levine et al., 2000). Most importantly, it provides opportunities to international investors to diversify their portfolios, thereby hedging idiosyncratic risk (Cochrane, 1991), and sometimes reduces consumption and income volatility. Consequently, financial integration actually leads to integration of the real sector (Brouwer, 1999). It is argued that financial integration leads to growth and reduces volatility through better macroeconomic management. A study by Obstfeld (1994) shows that international risk sharing through financial integration results in high growth and welfare gains.

(GDP) and inflation. The goods market approach[7] (Dornbusch and Fischer, 1980) and the portfolio approach[8] (Nath et al., 2003) illustrate the connection between foreign exchange and stock markets. Also, money market interest rates have a considerable effect on the investment decision in the capital market. With rising interest rates, investors expect higher yields on their investment in capital market assets (both bonds and securities, especially short-term securities), which might lead to a fall in the prices of shares and bonds.[9]

However, measuring financial market integration empirically is difficult as the financial instruments on which trade takes place differ in terms of participation (the money and credit markets involve participation of banks and other financial institutions operating within the country, while the foreign exchange market deals with cross-border transactions and stock markets with cross-listing of securities), maturity (short-term and long-term instruments), risk (government bonds are less risky than

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7 If there is any change in the exchange rate, it affects the cost of borrowing and the value of earning of a firm which borrows in foreign currency. As a consequence, the competitiveness of the firm gets affected; this in turn affects its stock prices. Also if there is any depreciation (appreciation) of the local currency, there is ademand (less demand) for exports in the foreign market, which increases the revenue of a firm and thereby its value, which gets reflected in rising stock prices. For an importing firm, the effects are opposite. So the net effect depends on the degree of international trade.

8 The exchange rate is determined by the market mechanism (demand-supply condition). A booming (falling) stock market makes the local currency appreciate (depreciate) by attracting (flight of) more foreign capital through foreign institutional investors. As a result, rising stock prices influence the exchange rate along with the money demand.

9 If the price of capital market assets represents the present value of discounted future cash flows, where interest rate is always the denominator, then the prices of capital market assets always move in the opposite direction of the interest rate. The effect of a change in the short-term interest rate appears more in the prices of bonds; the prices of shares often do not respond. But in the case of long-term interest rates, stock prices react more. A rise in the real interest rate reduces investments because of the higher cost of finance and low returns on capital, which get reflected in low dividends and low stock prices.

corporate bonds) and liquidity (money market instruments are more liquid than bonds in the capital market). Despite the heterogeneity across different financial markets, some of the theoretical principles, for example, LOOP, the term structure of interest rates, parity conditions, the capital asset pricing model, and arbitrage price, try to capture financial integration from different perspectives.[10] Here we group the measurement into three broad categories—the institutional/regulatory measure, the price measure, and the quantitative measure (Prasad et al 2003; 2006). The institutional/regulatory measure deals with the presence or absence of legal restrictions, though it sometimes fails to cover all impediments to financial integration. For example, capital flows may not be there even if there are no legal restrictions. The price-based measure includes asset price equalisation, convergence among market segments estimated by cross-market spreads, correlation among different interest rates and covered and uncovered interest rate parity. For the quantitative measure, other than liquidity and turnover, the commonly used criterion is capital flows in gross, as net flows may underestimate the measure of financial integration if a country experiences both high inflows and outflows.

We start with a brief description of India's institutional/regulatory policy reforms to uphold financial market integration. In the context of the development of the capital market, we examine the quantitative aspect of financial integration by considering the gross flow of capital on the capital account. To capture the integration of the domestic financial system (money, capital and foreign exchange markets), we extensively use the Johansen-Juselius (J-J) cointegration method in a multi-equation framework (comovement of one market as a function of

10 Integration of government bonds as short, medium and long-term is a good measure to understand the usefulness of the term structure of interest rates as it provides an important signal for inflation and growth (Blinder 2004). The capital asset pricing model or CAPM deals with the linkage between market instruments and risk-free instruments (government bonds). It examines the systematic risk to financial assets in a very simplified scenario with no taxes and transformation cost and identical investors (Sharpe 1964).

all other markets), as the major focus of studies so far (for details, see Section III) has been confined to examining one-to-one market comovement (either between the money and foreign exchange markets and/or the money and capital markets). The contemporary interlinkage of financial markets across borders has made it necessary to extend the study of India's external integration beyond the US economy. To achieve this, we consider both developed and developing countries. Further, we examine the existence of LOOP, depending on the result of J-J cointegration. As the theory of LOOP persists only in the case of risk-adjusted return on identical assets, we confine our study of international integration to the money and government security markets as these are considered to be relatively homogeneous across countries (systematic and idiosyncratic risk are negligible in these markets). Hence, corporate bond and equity and foreign exchange markets do not come under the purview of our analysis because of the associated systematic risk (idiosyncratic risk can be diversified away).[11]

The paper is organised into six sections. Section II depicts the backdrop of integration analysis of financial markets in the Indian context and we discuss the studies so far on the subject and its lacunae in Section III. Section IV describes the databases and methodology used. In Section V, we analyse the data using simple statistical tools and conduct an econometric investigation to analyse the extent of financial integration in India. Section VI concludes the study.

II Regulatory policies, quantitative measures and capital market development

To describe the backdrop of measuring financial integration in the context of India we focus on the three major aspects - regulatory or

11 Corporate bonds typically differ in their cash flow structure, liquidity and credit rating (the difference is smaller in the case of government bonds). Also, stock returns are expected to be determined mostly by the performance of the sector to which it belongs rather than the country it is listed in. For details, see Baele et al 2004.

institutional policy issues, the change in the gross flow of the capital market across borders and the liquidity of the capital market.

II.1 Regulatory/institutional policy issues

One of the major policy objectives of financial reform in India[12] was to integrate various segments of the financial markets with the aim of reducing arbitrage opportunities so as to implement an efficient allocation of resources (Mohan 2005; Reddy 1999; 2002). Since the degree of financial market integration is a phased phenomenon and depends mostly on policies and the institutional set up, we discuss some of the major institutional/regulatory policy issues that have figured in the task of developing a more integrated financial sector for efficient transmission of the monetary policy.[13]

(1) Additional financial assets: Additional instruments were introduced in the money market (certificates of deposit; commercial papers;[14] collateralised borrowing and lending obligation[15]) as the first

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12 Though India's capital account is not fully opened up, according to the IMF, it is classified as "largely liberalised". Historically, capital inflow took place in the form of foreign direct investment (FDI) in mining and plantation. During the 1970s, the inflow of capital was mostly in the form of syndicated loans to the government. The other forms of capital inflows such as investment in equities and bank lending to the private sector came much later (Sen 2006).

13 The monetary transmission mechanism describes the effect of policy-induced changes in the nominal money stock or the short-term nominal interest rate on real variables such as aggregate output and employment. Specific channels of monetary transmission operate through the effects that monetary policy has on interest rates, exchange rates, equity and real estate prices, bank lending, and the balance sheets of firms.

14 Certificates of deposit (CDs, 1989) are negotiable term deposit certificates, their maturity ranging from 15 days to one year. Commercial papers (CPs, 1990) are a short-term money market instrument issued by highly rated corporate entities and not backed up by any collateral. This is an unsecured promissory note.

15 The collateralised borrowing and lending obligation (CBLO) was introduced by the Clearing Corporation of India Ltd in 2003 for the benefit of entities who have either been phased out from the inter-bank call money market or whose participation has been restricted in terms of a ceiling on call borrowing and lending transactions and who do not have access to the call money market.

step towards securitisation of commercial banks' advances to marketable instruments so as to diversify corporate borrowers' short-term borrowings and enable them to raise a part of their requirement at a competitive price from the market. The CBLO provides avenues for non-bank institutes to deal with their short-term liquidity mismatches. For more effective open market operation and greater liquidity to retail investors, the ad-hoc treasury bill (TB)[16] was abolished in 1997 and regular auction was introduced. The liquidity adjustment facility (LAF) was introduced in 2000 for smooth functioning of the market repo,[17] a key equilibrating factor between the money and securities markets. It helps the Reserve Bank of India (RBI) to set the repo and reserve repo rate to reduce volatility and manage liquidity more efficiently.

(2) More participation and liquidity enhancement in the financial markets: More participation in the financial markets was a policy objective to enhance liquidity in the financial sector. Besides getting increased access to the call/notice money market,[18] banks were allowed

16 Treasury bills (TBs) are short-term risk-free debt instruments issued by the Central government for its cash management.

17 A repo, ready forward or buy back deal is a transaction in which two parties agree to sell and purchase the same security. Under such an agreement, the seller sells specified securities with an agreement to repurchase the same at a mutually decided future date and price. Similarly, the buyer purchases the securities with an agreement to resell the same to the seller. So the repo rate is the rate at which funds are borrowed by the money market (mainly overnight, as a means of relieving short-term shortage of funds) through the sale of short-term securities on the condition that the instruments will be repurchased at a given date. The reverse repo rate (reverse repurchase agreement) refers to the sale of securities by the central bank to the money market.

18 Call/notice money is the money borrowed or lent on demand for a short period of time (if overnight, it is known as call money; the money borrowed in a day and repaid on the next working day, or borrowed or lent for more than a day and up to 14 days is known as notice money). No collateral securities are required to cover this transaction. The call money market was developed primarily to increase overall integrity in the banking sector through the inter-banking facility and it is the most active segment of the money market where day-to-day imbalances in the funds position of scheduled commercial banks are erased. Call/notice money rates have been market determined since 1989. Interest rates in these markets are highly sensitive to demand-supply factors.

to invest in overseas money market instruments and/or debt instruments subject to limits approved by their board of directors to enhance the integration between the domestic and overseas money and capital markets (2003). The State Bank of India (SBI) entered into the capital market with an equity-cum-bond issue in 1993-94. To encourage the participation of foreign investors, the major and most important policy was to open up the stock market to foreign institutional investments (FIIs). In 1992, they were allowed to invest in government dated securities if they were registered with the Security Exchange Board of India (SEBI), and in 1998, they were allowed to invest in TBs. Authorised dealers (ADs) were also permitted to borrow and/or invest up to US$10 million (this amount was later relaxed gradually) from/in their overseas offices and correspondences without any conditions on end use and repayment of such borrowings. ADs were advised not to arbitrage between the money and foreign exchange markets and provide forward exchange cover to FIIs for their investment in debt instruments (1997) and the overseas money market. This helped to reduce volatility in the markets and encourage foreign participation.

(3) Market-determined rates: A market-determined interest rate on government securities in 1991 helped in making open market operations more efficient. Banks were allowed to buy and sell government securities freely at the market rate after 1997. The most important changes in the foreign exchange market[19] were the shift from a pegged exchange rate regime to a market-determined exchange rate in 1993, current

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19 Before the reforms, the foreign exchange market was mainly regulated by the Foreign Exchange Regulations Act (FERA), 1973 and characterised by strict regulation, less liquidity, barriers to entry and high transaction cost. The most important feature of the liberalisation of the external sector is related to the compositional shift in capital flows from debt to non-debt creating sources and regulation of external commercial borrowings. In priority industries, FDI has got automatic approval up to 51% of equity. In Indian stock exchanges, FIIs were allowed to invest without any restriction on volume of investments as well as on the lock-in period while domestic exporters could keep their earnings abroad for 180 days.

account convertibility in 1994 and phased convertibility of the capital account.

(4) Operational efficiency: A system of Delivery versus Payment (DvP) was introduced in the transaction of government securities from July 1995. To introduce more transparency, depth and liquidity to the money and capital markets, more power has been given to the SEBI for expanding the process of dematerialisation of securities along with adopting an electronic fund transfer and settlement system (1998). This reduces the settlement risk in securities transactions and strengthens the government securities market as well as guidelines and procedures for the enlistment of primary dealers. It also helps in increasing transactions in the secondary market.

II.2 Quantitative measure of financial integration

The quantitative measure of financial integration considers the gross flow of capital across borders. Here, we consider only the capital account transaction as a ratio of GDP to examine across-border capital flow, reflecting the transmission effect of price movements from one market to another as market participants rebalance their risk exposure.[20] We use the International Financial Statistics (IFS) database for all the sample countries (except India, as it is not reported) under two broad headings—capital account and financial account (we omit derivative transactions as the RBI data on capital account does not include it). Table 1 reveals that there has been an increase in capital flow as a percentage of GDP in India between 1991 and 2006. Canada, Italy and the UK also show a significant increase in gross flow of capital over the period. Though all the sample

20 Like merchandise trade integration (gross merchandise imports and exports as a percentage of GDP), the standard way of measuring overall integration of the economy is to calculate the gross flow on the current and capital account as a percentage of GDP. As capital flow across countries is our area of interest, we consider only the gross flow of capital on the current account as a percentage of GDP.

countries[21] (other than Japan) show an increasing trend, Brazil, Germany and the US are less integrated compared to other countries. This increasing capital flow might be because of relaxed regulatory measures, for example, firms being allowed to borrow abroad up to $500 million (which include loans or bond issues abroad that are foreign currency denominated) through "external commercial borrowing" with automatic approval by the government. Indian firms were allowed to invest overseas as well to reap the benefit of expanded market size and technology. The RBI buying US treasury bills and other foreign assets for accumulating foreign reserves was another important source of capital transactions. Renu Kohli (2009) has pointed out that the recent capital inflow is more in terms of portfolio capital (non-resident, equity participant) and overseas loans (foreign debt, residents).[22]

Table: 1 Gross Capital Flow (Capital Account) as a Percentage of GDP

	1991	1993	1998	2000	2002	2004	2006
Brazil	3.67	5.89	10.79	9.92	9.85	7.41	8.73
Canada	11.63	16.71	17.73	28.96	14.93	12.06	20.93
France	0.89	1.56	2.09	4.06	2.35	3.98	5.94
Germany	0.81	1.83	3.08	4.27	2.13	2.08	3.36
India	16.13	15.24	14.73	21.91	15.75	22.62	40.70
Italy	10.25	14.84	23.26	19.62	13.61	11.08	27.90
Japan	1.29	0.48	0.93	0.70	0.55	1.18	1.18
UK	2.28	5.17	3.48	10.87	3.16	9.17	10.79
US	0.32	0.73	0.88	1.66	0.98	2.17	2.53

Source: Compiled from the databases of the IFS, WDI and RBI, various issues.
Compound growth; original data is in current US$ million

21 We omit China and Korea because of some mismatch between the World Development Indicators (WDI) database and the IFS database.

22 FDI includes all kinds of capital contributions, such as the purchase of stocks, the reinvestment of earnings by a wholly owned firm incorporated abroad (subsidiary), and the lending of funds to a foreign subsidiary or branch. This may mainly take the form of buying or constructing a factory in a foreign country or adding improvements to such a facility, in the form of property, plants, or equipment. But foreign portfolio investment (FPI) can include bonds, money market instruments, financial options and debt securities. Sometimes both overlap.

In the case of portfolio investment, India has opened up to FIIs. Portfolio investors are free to bring capital in and out of the country without seeking permissions while there are no qualitative restrictions on participation by global firms. But there are two major restrictions in the case of equity investment by FIIs. One, aggregate foreign holding in a firm is limited (sometimes it is a sectoral limit applicable to certain sectors) by the shareholders of the firm and two, foreign ownership cannot exceed 10%. In the case of outbound portfolio investment, individuals are now permitted to take $200,000 per person per year. The participation of FIIs has played a major role in connecting different market segments and has had different policy implications. For example, the excess inflow of capital by FIIs creates an excess supply situation in the foreign exchange market, which in turn creates upward pressure on the exchange rate, bringing forward premia down. The aim of keeping the exchange rate stable makes the government interfere in the market by purchasing foreign exchange and injecting more liquidity into the domestic money market, which in turn eases the inter-bank call money rate and creates a spurt in turnover of the inter-bank call market. It should be noted that in 2007 the government introduced fresh controls on participatory notes (PNs)[23] to resolve difficulties in implementing the pegged exchange rate. But if there is any turbulence in financial markets in the world economy or a disturbance in the domestic market, it affects FII and there might be a flight of capital from the country, which would result in excess demand in the foreign exchange market. The government would then interfere by selling foreign exchange. The hardening liquidity situation would be reflected in a rise in the call rate and forward premia, which would result in a slow down in inter-bank call and forex market transactions. All this clearly indicates the importance of FIIs in the integration of different financial segments in India.

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23 PNs are over-the-counter (OTC) derivatives sold by a financial firm registered as an FII to an investor who is not registered.

II.3 Performance of the Indian capital market

Financial integration in the context of India's financial liberalisation is important because the country has become a crucial player in the world economy with its phased liberalisation and financial reform programme since 1990 (in terms of market capitalisation,[24] the Bombay Stock Exchange (BSE) ranked among the 10 biggest in the world; World Federation Exchange, 2007, Appendix, Table A1). Table 2 explores the growth of the Indian capital market in terms of the value of equity and bond trading compared to the sample countries.[25] It shows that in the value of equity trading, India had a higher growth rate than all the other sample countries except China and Brazil during 2001-07. In this period, the growth in the value of bond trading was also significantly high in the BSE though the National Stock Exchange (NSE) showed negative compound growth along with other sample stock exchanges such as Shanghai, Tokyo, Deutsche Börse and New York.[26] The probable explanation might be India's lower base of equity and bond trading compared to that of the developed countries.

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24 The domestic market capitalisation of a stock exchange is the total number of issued shares of domestic firms, including their several classes, multiplied by their respective prices at a given time. This reflects the comprehensive value of the market at that time. It includes only shares of domestic firms, and common and preferred shares and excludes investment funds,rights, warrants, options, futures, listed foreign shares, exchange traded funds (ETFs), and convertible instruments.

25 We have selected the sample countries from G-20 countries by considering India's annual average GDP for the period 2003-08 as the benchmark and including all those that had more or equal average GDP growth in the last couple of years (Brazil, Canada, China, France, India, Italy, Japan, Germany, Korea, UK, US). We included Korea even though it had an annual average GDP just below India's in the same period. We considered Brazil for the comparative analysis of capital markets but we need to exclude it here as an outlier because of its very high call money rates.

26 In absolute terms, developed countries such as the US and the UK have been experiencing a very high trading value for both share and bond trading on an average, see WFE, 2007.

Table 2: A Country-wise Comparison of the Growth Rate of Value of Equity and Bond Trading (2001-2007)

Country	Stock Exchange	Share Trading # (%)	Bond Trading # (%)
Brazil	Sao Paolo	37.77	18.05
Canada	TSX	19.80	37.30
China	Shanghai SE	45.79	-10.71
France	Euro Next	15.22	38.74
India	BSE	19.18	49.97
India	NSE	26.22	-14.63
Italy	Borsa Italiana	20.31	7.73
Japan	Tokyo SE	21.47	-23.80
Germany	Deutsche Börse	17.21	-6.75
Korea	Korea Exchange*	26.85	65.95
UK	London SE	12.54	12.85
US	NYSE	16.15	-26.58

Note: # Indicates compound growth rate. Because of the unavailability of data for France, we calculate the result for 2002-2007, while for the US, it is 2001-2006.

* From 2004, trading value includes Kosdaq following the integration of the Korea Exchange.

Source: Compiled from World Federation of Exchange, various issues (annual data in US$)

Also, over the period of 2001-2007, India experienced a significant increase in the value of equity trading (Appendix, Table A2) and bond trading (Appendix, Table A3) as a percentage of GDP, an indicator of the liquidity of the capital market as it involves cost and risk in the capital market.[27] It is a robust indicator of economic growth (not market

27 The trading value of both equity and bond markets in India (Appendix, Table A1 and Table A2) are quite low in absolute terms compared to all industrialised countries.

capitalisation, Levine et al 1998). Though the average value of equity trading as a percentage of GDP of India is not more than that of other developed countries, it is much higher than that of developing countries like Brazil and China and it is comparable to Canada, Germany, Italy, and Japan. However, the average value of bond trading as a percentage of GDP is quite high in India though it does show a little fluctuation over the period. Also, it should be mentioned that the liquidity of India's bond market is significantly low compared to the liquidity of equity market.

III Financial integration: a review

In this section, we discuss a few studies that estimate financial integration by using different empirical measures, and then look into the literature related to the integration of the Indian financial sector.

III.1 Empirical studies

Integration of financial markets domestically as well as internationally can be measured in terms of equalisation of returns on similar financial assets or it can be seen as the co-movement of similar kinds of financial assets. Anderson et al. (2005) find that financial integration leads to high correlation among different asset prices (especially high-yield bond and equity prices) in developed and emerging countries' financial markets. Feldstein and Horioka (1980) and Feldstein (1983) (also see Haque 1990) consider that the degree of correlation between national savings and investment is a way to measure financial market integration because theory says that the perfect mobility of capital breaks the link between national savings and investment if a country can borrow sufficient funds from outside to make up for a shortfall in savings. They find that portfolio preference and institutional rigidities hold back the international flow of long-term capital and, as a result, any increase in domestic saving gets reflected primarily in additional domestic investment. They argue that in an internationally integrated market, it is the short-term flow of capital which eliminates

short-term interest rate differentials. Later, Taylor (1994) criticised this finding and concluded in favour of the international mobility of capital. Quyyam et al. (2005) used the same methodology to examine the financial integration of five countries—Bangladesh, India, Nepal, Pakistan and Sri Lanka—and concluded that the financial markets of these countries were not perfectly integrated with the world economy. Lane et al. (2006) in their paper show gross capital flow as an indicator of the pace of financial integration. They estimate financial integration in terms of a country's share in the global holding of external assets and liabilities.[28] Considering countries such as China and India, they find that the composition of their gross assets and liabilities are quite asymmetric. The liabilities of these countries are mostly FDI, debt and portfolio equities, which yield on an average high returns, though portfolio investment is a relatively dominant component in the case of India while FDI is the leading factor in China. Moosa et al. (1997) examined the degree of integration between goods and financial markets in Japan and six other countries. They used uncovered interest rate parity and ex-ante purchasing power parity over the period 1980-1994 and found a high level of cointegration between goods and financial markets. Gérard et al (2003), using the intertemporal capital asset pricing model (ICAPM) for monthly dollar-denominated returns on stock indices for three developed markets—the US, Japan and Hong Kong—and for three emerging markets—Thailand, Malaysia and Korea, found little evidence of market segmentation over 1985-1998.

III. 2 Studies in the context of the Indian economy

Table 3 gives a brief description of some of the literature on the horizontal and vertical integration of Indian financial markets, using different methodologies and in different time frames.

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28 Financial integration leads to a high level of reserve holding in countries such as China and India. Reserves are held mostly to protect against adverse shocks. They are mostly low return, which are highly liquid in nature and carry a high opportunity cost.

Table 3: Horizontal and Vertical Integration of Indian Financial Markets

Author (Year)	Country (Period)	Variables		Methodology/Model	Results
		Horizontal	Vertical		
Bhoi et al. (1998)	India and India,US (April 1993 to March 1998)	CMR, CDR, CPR, DRT, LRT, G91, G364, RE, PERN, FR3	FR6 of the US and USTB	Johansen (1988) Cointegration test	Indication of horizontal (money and forex market) integration, but vertical integration is not robust.
Bhatt and Virmani (2005)	India, US (1991-92 to 2003-04)		IDIFF and F	Johansen (1988) Cointegration test	Vertical integration (three-month money market rate)
Virmani (2007)	India, US (1992-2006)		One year G-Sec of US and Indian 364TB	Convergence test	Convergence shows the evidence of vertical integration
Nath et al. (2003)	India (April 1993 to March 2003)	NF and ER		Granger Causality Test in VAR framework and	First methodology says very poor causal link (foreign exchange

			Geweke's Feedback Measure	market and stock market) while second methodology says very strong causal relationship as well as bidirectional horizontal integration.
Nag et al. (1999-2000)	India (October 1996 to July 1999)	Call, BSE, INR	Artificial Neutral Network Architectures (ANN) and Self Organising Feature Map (SOFM)	Gradual horizontal integration between short-term money market and forex market but no significant interlinkage of capital market with other market segments

Notations for the variables are taken from the original papers.

CMR: Call money rate, CDR: Certificates of deposit rate, CPR: Commercial paper rate, DRT: Deposit rate, LRT: Lending rate, G91: 91-day treasury bill rate, G364: 364-day treasury bill rate, RE: Return on capital (capital gains and dividend yields), PERN: Price-earning ratio of 100 Scrip National Index, FR3: 3-month forward premium, FR6: 6-month forward premium in US dollars, USTB: US treasury bill rate, IDIFF: 3-month treasury bill interest differential between India and US, NF: S&P CNX Nifty of National Stock Exchange, ER: Exchange rate (Indian rupee/US dollar), Call: Call money rate, BSE: BSE Sensex, INR: Rupee-dollar rate.

III.3 Lacunae of existing studies

Though some of the studies conclude that the money and foreign exchange markets are integrated, the results are sometimes dubious for different market segments. In particular, empirical evidence of the comovement of the capital market with other markets is lacking. Overall, these studies use the cointegration analysis in a bi-variate framework. Hence, they could all examine whether the money and exchange markets, or the money and capital markets, or the capital and exchange markets are cointegrated. But none of them measure the comovement of all the major financial markets as a whole. So, we consider cointegration of each of these markets as a function of all other markets. In the case of international integration of the Indian financial market, all studies are restricted to the US financial market. With these lacunae in the existing literature, our aim is to examine India's financial integration in the multivariate framework of J-J. For example, if we consider the money, capital and foreign exchange markets, then we examine the comovement of all the markets with the following combinations.

money market = f (capital market, exchange market)
capital market = f (money market and exchange market)
exchange market = f (money market and capital market)

If there are three cointegrating vectors, we can conclude that all these three markets are cointegrated. If there are less than three cointegrating vectors, we examine comovement using different pair-wise combinations of the variables. Similarly, our study extends the analysis of international integration of India's financial market beyond the US economy, incorporating both developed (US, UK, Germany, Japan) and developing (China, Brazil, Korea) countries.

IV Databases and methodology

We depend on the databases of the World Development Indicators (WDI 2008, CD-ROM), the World Federation of Exchange (WFE, various

issues), the IFS (IFS March 2008, CD-ROM) of the International Monetary Fund (IMF) and the Handbook of Monetary Statistics of India, RBI (various issues). Though the WFE provides the database for most of the important stock exchanges from 1990 onwards, for India, the database covers only the period after 2001 (the availability of the data varies for some other countries as well). For cointegration analysis we mainly depend on the monthly data of the IFS for all the countries other than India. For India, we use the data from various issues of the RBI Handbook of Monetary Statistics. Where data is not available (data on 10-year bond yields and 91-day Treasury Bill rates for India are not available after 1990), we restrict our cointegration and convergence analyses to different time periods. For the call money rate, we consider the period from 1990 (1) to 2007 (7) for measuring international integration across countries. For measuring domestic market integration, we consider the period from 1997 (1) to 2007 (7). Here, because of the non-availability of data we restrict our analysis to a 10-year time frame but as we have chosen the J-J cointegration test in a multi-equation framework, we examine the maximum possible combinations of the variables to determine the existence of cointegration. A few missing values in the data set are filled with the average value of the consecutive data. All the variables we use for our analysis are given below. (on page 26)

The study adopts simple statistical analysis for preliminary inferences, followed by cointegration and convergence analyses. We use the J-J test (1990) for both horizontal (call, Yield10, EXCH, and LBSES)[29] and vertical integration (call, TB91 and Yield10).[30] We

29 For these variables, correlation coefficients show a significant increase over the period (shown in the next section).

30 In theory, there are many interest rates which are relevant to monetary policy but sometimes they are highly correlated during cyclical fluctuations. As a consequence, it is difficult to provide a stable structural model by using those variables. Brayton and Marquez (1990) suggested the call rate as the short-term rate and the 10-year government bond yield as the long-term rate most relevant to monetary policy.

Market		Variable	Variable Description
Money Market		Call	Inter-bank call money rate (basically inter-bank short-term interest rate, which is known differently in different sample countries with maturities varying from one week to three months. We use the monthly average for each country.)
		TB91	91-day treasury bill rate
		TB364	364-day treasury bill rate
Capital Market	Bond Market	Yield10	10-year bond yield
	Equity Market	LBSES	Natural logarithm of BSE (Sensitive) Index
Foreign Exchange Market		FR1	1-month forward exchange premia
		FR3	3-month forward exchange premia
		FR6	6-month forward exchange premia
		EXCH	Exchange rate for Indian rupee/US dollar

examine the convergence of India's call money market rate with the short-term inter-bank rate of the sample countries.[31]

To examine the long-run relationship of a multi-equation system, the J-J test of cointegration is a more developed method than the Granger (1981) and Engle-Granger (1987) tests, used in a single-equation framework. We examine cointegration of a non-stationary series if they are integrated of the same order.[32] To test stationarity of the series, we use the Augmented Dickey-Fuller (ADF) test (1979),[33] a modified version of the DF test.[34] In the ADF test, the null hypothesis: presence of unit root or the level variables are non-stationary. If two non-stationary series y_t and x_t are integrated of the same order, say, of order one, and if their linear combination is stationary, then it can be said that they are cointegrated. It implies that the regression of these two variables $y_t = \beta x_t + u_t$ is not spurious and in the long run, these two variables move together. The J-J test of cointegration has two test statistics—trace test - null hypothesis: there exists at most r cointegrating vectors, and maximum eigenvalue test - null hypothesis: there are r cointegrating vectors against the alternative hypothesis that there are r+1 cointegrating vectors.

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31 The call money rate is an important rate to balance liquidity in the market. For India, the call money market rate shows a random walk process, which is consistent with the efficient market hypothesis (one convenient way to examine market efficiency is to plot the first difference of the rate variable) and it is an important criteria for the theoretical implications of the reference rate.

32 Persistence of the unit root leads to the non-stationarity problem of an economic time series. In other words, if the characteristics of a stochastic process (mean, variance, autocovariance) change over time, then the series is non-stationary. If these characteristics are constant over time, the series is stationary.

33 The ADF test involves three functional forms of simple autoregression, with and without constant or time trends in testing for the unit root. Graphic analyses of our data series show most of the variables have a clear trend and some do not have any discernible trend. To generalise the results, we apply all the three functional forms to all the data sets.

34 For more details, see Dickey and Fuller 1979; 1981.

We use a time-series stochastic convergence[35] test to examine convergence of the short-term inter-bank rate among the sample countries to find out whether LOOP prevails. Here, we use the difference between a country i's call money market rate and the group's average for a given year, which is related to the previous year's gap. The relation can be described as follows:

$$(y_{i,t} - \bar{y}_t) = \alpha \quad (y_{i,t-1} - \bar{y}_{t-1})$$

$(y_{i,t} - \bar{y}_t)$ = mean deviation which shows the difference between the short-term inter-bank rate for the i-th country from the group's mean at the t-th period.

$(y_{i,t-1} - \bar{y}_{t-1})$ = same as above for the t-1 time period.

$y_{i,t}$, $y_{i,t-1}$ = short-term inter-bank rate for i-th country at the t-th and t-1 th time periods, respectively.

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35 There are two methods of testing convergence in a time series: deterministic and stochastic time series analyses. The convergence test is the most discussed analysis in the literature on growth and there are several methods to measure it. Among them, the two main approaches to measure income convergence are i) measure of inequality, which includes standard deviation, coefficient of variation, Gini coefficient, Theil's index of inequality, etc. and ii) econometric testing, which includes cross section, time series and panel data analysis. Another test of convergence is β convergence (Baumol 1986), which regresses the growth rate over a given period, on an intercept term and the initial level of per capita income. The method of β convergence of per capita income across nations or regions often describes a neoclassical growth model. The equation for β convergence can be shown as $x = \alpha + \beta \ln Y_{i,t-1} + \varepsilon$; where x = growth of per capita income, and $Y_{i,t-1}$= initial per capita income for country i. β<0 implies absolute convergence and â=0 implies no relation between growth rate and initial level of per capita income. The test of convergence can be measured by coefficient of variation (SD/ Mean *100) as well, known as sigma convergence (Abramovitz 1986). If the relative variance or coefficient of variation falls over a specific period, then it can be considered as evidence of convergence. For detailed analyses, see Ahmed and Ismail 2008.

$\bar{y}_t$, $\bar{y}_{t-1}$ = geometric mean of short-term inter-bank rate for all the sample countries (group mean) at the t-th and t-1 th periods, respectively.

α = convergence coefficient; $\alpha < 1$ implies convergence and $\alpha > 1$ implies divergence.

To examine the convergence of the stochastic series, we use the unit root test.

V Empirical analysis of financial integration in India

For a preliminary analysis of integration among different markets within the country, we start by examining correlation coefficients among call, TB 91, TB364, Yield10, FR1, FR3, FR6, LBSES and EXCH. We can see an increasing correlation among different rates of return in all the three market segments – money, capital and foreign exchange, especially after 2000 (Table 4), which is an indicator of increasing financial integration among different segments of the domestic market.

The correlation coefficient in most of the cases shows significant improvements in the second period of analysis. The exchange rate has a positive correlation with all other variables in the latter phase while the correlation of the call rate shows noticeable improvements with TB91, TB364, and yield rate. The high correlation of asset prices among the different segments of the money market, the risk-free and more liquid Treasury Bill market, and foreign exchange premia is an indicator of an effective price discovery process, which in turn facilitates the closer coordination of monetary and external sector management. The high correlation between long-term government bond yields shows the significance of the term structure of interest rates in financial markets. The negative correlation of LBSES with each and every other rate of return is an indicator of increasing positive correlation with the interest rate as the Sensex is an indicator of price and price is negatively related to the interest rate. As a correlation analysis is not a sound method to investigate comovements (financial rates of returns are characterised by

Table 4: Correlation among Major Financial Markets

	CALL	TB91	TB364	YIELD10	FR1	FR3	FR6	EXCH	LBSES
	JAN 1993 to DEC 2000								
CALL	1								
TB91	0.75*	1							
TB364	0.55*	0.77*	1						
YIELD10	-0.02	0.52	0.46*	1					
FR1	0.79*	0.62*	0.54*	0.41*	1				
FR3	0.67*	0.56*	0.59*	0.57*	0.97*	1			
FR6	0.6*	0.51*	0.6*	0.66*	0.91*	0.98*	1		
EXCH	-0.05	-0.22**	-0.08	-0.65*	-0.32*	0.15	0.26	1	
LBSES	-0.05	0.22	-0.83	-0.65*	-0.31*	0.01	0.002	0.998*	1
JAN 2001 to July 2007									
CALL	1								
TB91	0.82*	1							
TB364	0.84*	0.98*	1						
YIELD10	0.63*	0.92*	0.95*	1					
FR1	0.66*	0.62*	0.57*	0.54*	1				
FR3	0.59*	0.63*	0.6*	0.59*	0.97*	1			
FR6	0.55*	0.63*	0.6*	0.61*	0.93*	0.99*	1		
EXCH	0.23*	0.07	0.08	0.09*	0.4*	0.5*	0.51*	1	
LBSES	-0.38*	-0.42*	-0.46*	-0.52*	-0.46*	-0.54*	-0.6*	-0.52*	1

*Significant at the 5% level. ** Significant at the 10% level

Source: Calculated from data in the Handbook of Monetary Statistics of India, RBI, various issues.

random walk properties),[36] we analyse the results of J-J cointegration and a time series convergence test in the next section.

V.1 Econometric estimation and empirical result

In country analysis, we start with a statistical check on the non-stationarity of the variables; call, Yield10, EXCH and LBSES representing rates of return of major domestic financial market segments by both the graphic method (Appendix, Figure A1) and the ADF test. In the graphical method as we find the Auto Correlation Function (ACF) is not fast decreasing, we conclude these series are non-stationary. Also, the result of the ADF test shows that all these rates of return are non-stationary at their levels and stationary at their first difference (Table 5), that is, all these series are integrated of order one, I(1). Next, we examine cointegration among these four rates of return in the framework of the J-J cointegration test. We find that the maximum two variables among the four have two-way dependencies or there are utmost two cointegrating vectors (Appendix, Table A4.1). We use different combinations of the concerned variables as the J-J test does not help us to identify the functional relationship of the cointegrated series. In case of combinations of call rate, Yield10, EXCH (Appendix, Table A4.2) and Yield10, EXCH, LBSES (Appendix, Table A4.5), there is utmost one cointegrating vector. For the other combinations, such as call, Yield10, LBSES (Appendix, Table A4.3) and call rate, EXCH, LBSES (Appendix, Table A4.4), there are utmost two cointegrating vectors. These results again lead to no definite conclusion though it is evident that there exists comovement among all these different rates of return. So we do paired wise comovement analysis for different combinations of different market rates. All the combinations (Appendix Table A4.6, A4.8, A4.9, A4.10, A4.11) other than call rate, EXCH show that there is utmost one cointegrating vector, and for call rate, EXCH (Appendix, Table A4.7) we find there are two cointegrating vectors.

36 Future prices cannot be predicted from current prices or these rates are non-stationary and have no tendency to revert to an underlying trend value (or mean value). The variance is infinite and estimates of the parameter are inconsistent.

Table 5: Unit Root Test of Rates of Return of Different Markets: 1997 (1) - 2007 (7)

	Call	Yield10	EXCH	LBSES
Level Variable				
Constant and Trend	-7.402** (0)	-0.7684 (0)	-1.520 (1)	-2.208 (2)
Constant	-4.398** (1)	-1.544 (0)	-2.622 (1)	-0.4791 (3)
No Constant, No Trend	-0.8741 (2)	-1.576 (0)	0.3333 (1)	1.465(3)
Inference	Unit Root	Unit Root	Unit Root	Unit Root
First Difference Variable				
Constant and Trend	-7.548** (3)	-11.25** (0)	-7.860** (0)	-9.891**(2)
Constant	-7.535** (3)	-11.22** (0)	-7.029** (0)	-9.929** (2)
No Constant, No Trend	-6.448** (5)	-11.18** (0)	-7.031** (0)	-14.40** (1)
Inference	No Unit Root	No Unit Root	No Unit Root	No Unit Root

T = 120, ADF (D-lag) statistics corresponding to minimum AIC, With Constant and Trend 5% = -3.45, 1% = -4.04; Constant 5% = -2.89 1% = -3.49; No Constant and No Trend 5% = -1.94 1% = -2.58.
Original data is in percentage.

The J-J cointegration test of call, TB91 and Yield10 across the selected countries is basically intended to explore how India is getting integrated with the world economy. The ADF test for each of the variables shows that all these rates of return are non-stationary at their levels and stationary at their first difference (Table 6, Table 7, and Table 8). As India is our focus of analysis, we test the cointegration by taking those combinations where India shows forward and backward comovement with the other countries. For example, in the case of a three countries combination, we take only combinations of the utmost three cointegrating vectors to form a combination of four countries for the next step of analysis. For each of the three variables, call, TB91, Yield10, we start by examining the bi-variate J-J test between India and one of the sample countries. Later, we examine different combinations of the sample countries by adding on countries.

Table 6: Unit Root Test for Call or Short-term Inter-bank Rates: 1990 (1) – 2007 (7)

	Canada	Germany	Italy	Japan	India	Korea	UK	US
Level Variable								
Constant and Trend	-3.605* (2)	-1.566 (4)	-2.115(2)	-2.296 (4)	-4.600**(3)	-3.804* (3)	-2.683 (4)	-2.612 (3)
Constant	-4.115** (1)	-1.736 (4)	-1.519(2)	-3.319*(4)	-3.130*(3)	-2.043 (1)	-3.687** (4)	-2.803 (3)
No Constant, No Trend	-3.028** (1)	-1.246 (4)	-1.557(2)	-3.654**(4)	-1.400(4)	-1.467(1)	-2.724**(4)	-1.349(3)
Inference	Unit Root	Unit Root	Unit Root	Unit Root	Unit Root	Unit Root	Unit Root	Unit Root
First Difference Variable								
Constant and Trend	-11.49** (0)	-3.774*(3)	-8.261**(1)	-4.398** (3)	-9.843**(4)	-11.09**(0)	-5.183** (4)	-4.016**(2)
Constant	-11.25** (0)	-3.622**(3)	-8.250**(1)	-9.868**(3)	-9.868**(4)	-11.12**(0)	-4.687**(4)	-3.848**(2)
No Constant, No Trend	-11.18** (0)	-3.589**(3)	-8.227**(1)	-3.390**(3)	-9.888**(4)	-11.13**(0)	-4.555**(4)	-3.838**(2)
	Stationary	Stationary	Stationary	Stationary	Stationary	Stationary	Stationary	Stationary

T = 201; ADF (D-lag) statistics corresponding to minimum AIC, Constant + Trend 5% = -3.43 1% = -4.01; Constant 5% = -2.88 1% = -3.46; No Trend, No Constant 5% = -1.94 1% = -2.58.
Original data is in percentage.

Table 7: Unit Root Test for 10-Year Bond Yields: 1997 (1) – 2007 (7)

	Canada	France	Germany	India	Italy	Japan	Korea	UK	US
	Level Variable								
Constant and Trend	-3.267(4)	-2.362(3)	-2.509(3)	-0.7904 (0)	-2.733 (1)	-3.682* (1)	-2.841 (4)	-2.492 (3)	-2.499(1)
Constant	-2.405(3)	-2.257(3)	-2.421(3)	-1.636 (0)	-3.196*(1)	-3.675**(1)	-1.749 (3)	-2.668(3)	-2.583 (1)
No Constant, No Trend	-1.599(3)	-0.7626(3)	-0.8379(3)	-1.669 (0)	-1.424 (1)	-0.6381(4)	-1.286(3)	-0.7648(3)	-1.055(2)
Inference	I (1)	I (1)	I (1)	I (1)	I (1)	I (1)	I (1)	I (1)	I (1)
	First Difference Variable								
Constant and Trend	-5.987**(2)	-5.250**(2)	-5.185**(2)	-10.94**(0)	-8.498**(0)	-7.682**(3)	-5.345**(2)	-5.146**(2)	-8.241**(1)
Constant	-5.983**(2)	-5.174**(2)	-5.088**(2)	-10.82**(0)	-8.275**(0)	-7.634**(3)	-5.341**(2)	-4.913**(2)	-8.157**(1)
No Constant, No Trend	-5.898**(2)	-5.175**(2)	-5.082**(2)	-10.74**(0)	-8.239**(0)	-7.666**(3)	-5.319**(2)	-4.909**(2)	-8.154**(1)
Inference	No Unit Root	No Unit Root	No Unit Root	No Unit Root	No Unit Root	No Unit No	No. Unit Root	No Unit Root	No Unit Root

ADF statistics (D-lag) corresponding to the minimum AIC, T = 121, Constant + Trend 5% = -3.45 1% = -4.04; Constant 5% = -2.89 1% = -3.49; No Constant, No Trend 5% = -1.94 1% = -2.58.
Original data is in percentage.

Table 8: Unit Root Test for 3-Month Treasury Bill: Level Variable: 1997 (1) – 2007 (7)

	Canada	France	India	UK	US
Level Variable					
Constant and Trend	-2.100 (2)	-2.089 (3)	-2.789 (1)	-1.581 (2)	-1.382 (3)
Constant	-1.934 (2)	-2.244 (3)	-2.145 (1)	-1.938 (2)	-1.671 (3)
No Constant, No Trend	-0.09289 (2)	-0.4206 (3)	-0.3159 (3)	-0.4696 (2)	-0.7326 (3)
	Unit Root	Unit Root	Unit Root	Unit Root	Unit Root
First Difference Variable					
Constant and Trend	-4.373**(1)	-3.131 (2)	-8.930** (2)	-5.663** (0)	-3.280 (2)
Constant	-4.392** (1)	-3.076* (2)	-8.956** (2)	-4.279** (1)	-3.203* (2)
No Constant, No Trend	-4.380** (1)	-3.081** (2)	-8.989** (2)	-4.291** (1)	-3.220** (2)
Inference	No Unit Root	Unit Root	No Unit Root	No Unit Root	Unit Root

ADF statistics (D-lag) corresponding to the minimum AIC, T = 121, Constant + Trend 5% = -3.45 1% = -4.04; Constant 5% = -2.89 1% = -3.49; No Constant, No Trend 5% = -1.94 1% = -2.58.

Appendix, Table A5 shows that India's call money rate has strong comovement with both forward and backward feedback from the short-term inter-bank rates of Canada, Japan and the UK, while there is cointegration with other countries such as Germany, Italy, Korea and the US. It implies that India's call money rate has comovement with our sample countries (Appendix A5.1). Next, we continue the J-J test with different combinations, maintaining India as the focal point to understand whether this comovement leads to any clubbing among these countries. Appendix, Table A5.2 shows that combinations like (i) Canada, India, Germany, (ii) Canada, India, Japan, (iii) Canada, India, UK, (iv) Japan, India, Germany, (v) Japan, India, Korea, (vi) Japan, India, UK, (vii) Japan, India, US, and (viii) India, Germany, UK have utmost three integrating vectors, which is an indication of both forward and backward cointegration. Appendix, Table A5.3 shows four-country combinations such as (i) Canada, India, Germany, Japan, (ii) Canada, India, UK, Japan, (iii) Canada, India, Germany, UK, and (iv) Canada, India, Germany, US have utmost four cointegrating vectors. Five-country combinations (Appendix, Table A5.4) such as (i) Canada, India, Germany, Japan, UK, and (ii) Canada, India, UK, Germany, US, have utmost five cointegrating vectors. Though Appendix, Table A5.5 shows that all the six countries are not clubbed together, we can say that India's call money rate has very significant comovement with that of Canada, Germany, Japan and the UK, and Canada, Germany, the UK and the US.

Next, the ADF test of stochastic convergence analysis of short-term inter-bank rate (Table 9) reveals that with constant and trend countries such as Canada, India, Korea and the UK and with no constant, no trend countries such as Canada, Germany and India, the null hypothesis of the existence of the unit root is rejected. For India, a fast decreasing ACF confirms the evidence of LOOP though for all other countries a slow decay of ACF casts doubt on the stationarity of those series (Appendix, Figure A2).

Table 9: Unit Root Test of Mean Deviation of Call or Short-term Inter-bank Rates: 1990 (1) – 2007 (7)

	Canada	Germany	Italy	Japan	India	Korea	UK	US
Constant and Trend	-4.326**(0)	-2.223(0)	-3.183(1)	-2.440(0)	-8.368**(0)	-3.648*(3)	-3.841*(1)	-1.333(0)
Constant	-2.731 (0)	-2.204 (0)	-2.514 (1)	-1.803 (0)	-8.19**(0)	-2.745 (1)	-2.701 (1)	-0.7299 (1)
No Constant, No Trend	-2.672**(0)	-2.158*(0)	-1.637(1)	-0.8095(0)	-2.532*(3)	-1.712(1)	-1.824(1)	0.7683(0)

T=206, ADF (D-lag) statistics corresponding to minimum AIC, Constant + Trend 5% = -3.43 1% = -4.01; Constant 5% = -2.88 1% = -3.46; No Trend, No Constant 5% = -1.94 1% = -2.58

Appendix, Table A6.1 describes the bivariate result of the cointegration analysis for 10-year government bond yields and we can see that only the UK and US economies show either forward or backward comovement with India's 10-year government bond yield. But Appendix, Table A6.2 clearly indicates that there is no clubbing across these three countries with only one cointegrating vector.

In the case of TB 91, we analyse the cointegration among three countries, Canada, India, and the UK, while excluding France and the US because these two countries have a degree of integration more than one which is different from the other three countries of I(1). The J-J cointegration analysis shows that India's TB 91 has either forward or backward comovement (Appendix, Table A7.1, A7.2) with both Canada and the UK with no significant indication of clubbing.

VI Conclusion

As each country's financial system differs in terms of institutional factors, regulatory framework, the integration of financial markets across borders raises the issue of maintaining internal financial stability of a country in isolation. Our finding of integration of Indian financial markets, domestically and internationally is important to address the problem of regulation of financial flows across border. Preliminary analysis concludes that India's capital market has become significantly liquid with a highly liquid equity market. As it is well recognised that capital market liquidity is a robust predictor of economic growth, the less liquid bond market represents an important policy issue. This imbalance raises the question whether India's highly liquid equity market will serve as a substitute for an illiquid bond market.

With increasing correlation across different markets, the J-J analysis of cointegration test concludes that financial integration is very much evident in all the domestic markets of India—short-term money, equity, debt, and foreign exchange. It may be categorised as a phased integration,

which started with strong comovement between the domestic call money market and the foreign exchange market, and spread to the capital and foreign exchange markets.

International cointegration, in terms of the short-term inter-bank rate, is significant and it forms two different clubs, in which India, Canada, Germany and the UK are common members. Our study concludes that LOOP holds for India's short- term inter-bank rate. Treasury bill 91 shows weak evidence of international integration. Though there is an outward-looking trend in India's bond market, it is not widely integrated with the world economy (weak evidence persists with Yeild10), which possibly explains one of the reasons why India was not much affected by the US subprime crisis where securitisation of debt played a significant role. Apparently, internationally integrated financial markets are more prone to world financial crises, though it is also important to maintain high liquidity in the domestic market to raise sufficient fund for the real sector economy. Hence, the trade-off between internal and external financial integration raises two crucial issues. First, the interlinkage between the banking sector and the capital market adds to the controversy how far opening up of the main depository sector, like commercial banks to capital market is safe for maintaining internal stability and the growth of the economy. This issue needs to be re-examined in the context of securitisation, where the capital market and the banking sector are two important pillars of growth. Second, we need a balanced policy regime to maintain financial stability within the country when it is integrated with the world economy (short-term trading of complex securities, in particular, is a very crucial issue). Consequently, India's financial integration both domestically and internationally raises the need to closely analyse the monetary transmission mechanism to understand the changing dynamics of the financial and real sector economy.

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APPENDICES

Table A1: Top 10 Stock Exchanges in terms of Domestic Market Capitalisation (US$ billion)

	2007	% Change 2006-07
NYSE Group	15650.8	1.5
Tokyo SE Group	4330.9	-6.1
Eoronext	4222.7	13.7
Nasdaq	4013.2	3.8
London	3851.7	1.5
Shanghai SE	3694.3	302.7
Hong Kong Exchanges	2654.4	54.8
TSX Group	2186.8	28.6
Deutsche Borse	2105.2	28.6
Bombay SE	1819.1	122.1

Source: World Federation of Exchange, 2007

Table A2: Value of Share Trading as a Percentage of GDP (US$ million): 2001-07

Countries	Stock Exchanges	2001	2002	200 3	2004	2005	2006	2007	Average
Brazil	Sao Paolo	11.49	9.15	12.02	15.67	18.73	25.86	45.50	23.82
Canada	TSX	64.52	55.56	54.45	65.62	79.57	100.80	123.26	82.54
China	Shanghai SE	21.94	14.56	15.60	16.71	10.63	27.70	124.07	42.15
France	Euro Next	156.19	135.46	107.59	119.93	136.03	171.40	220.11	153.43
Germany	Deutsche Börse	75.27	60.11	53.26	56.24	68.72	94.49	131.17	79.99
India	**BSE and NSE**	**51.87**	**38.86**	**48.71**	**54.02**	**58.57**	**69.64**	**93.53**	**64.12**
Italy	Borsa Italiana	56.74	52.05	54.45	56.14	73.10	85.97	109.73	73.07
Japan	Tokyo SE	40.53	39.92	49.86	69.87	98.52	133.29	147.97	84.04
Korea	Korea Exchange*	78.78	109.09	75.48	91.87	152.97	151.10	206.85	133.27
UK	London SE	314.97	254.55	199.13	239.97	254.39	318.54	378.83	285.69
US	NYSE	104.10	98.97	88.85	99.66	113.93	165.52	216.56	130.94

Source: Calculated from World Federation of Exchange data

Over the period, values are calculated as (value of share trading US$ million/GDP current US$ million) *100. Average is the (average value of share trading over the period 2001-2007/average GDP for the same period) *100.

Table A3: Value of Bond Trading as a Percentage of GDP (US$ million): 2001-07

Countries	Stock Exchanges	2001	2002	2003	2004	2005	2006	2007	Average
Brazil	Sao Paolo	0.027	0.141	0.067	0.087	0.095	0.053	0.037	0.07
Canada	TSX	0.073	0.346	0.438	0.280	0.322	0.365	0.360	0.32
China	Shanghai SE	3.806	5.346	4.282	1.912	1.754	0.866	0.695	2.21
France	Euro Next	NA	1.350	1.482	11.244	8.278	17.356	7.600	8.92
Germany	Deutsche Börse	27.216	20.455	18.835	16.130	13.673	9.948	9.573	15.57
India	BSE and NSE	37.960	43.702	48.114	29.832	17.469	5.062	5.158	22.17
Italy	Borsa Italiana	10.948	12.640	11.162	10.903	8.715	8.432	9.775	10.17
Japan	Tokyo SE	0.484	0.387	0.218	0.156	0.134	0.117	0.068	0.22
Korea	Korea Exchange*	2.281	7.923	29.005	49.601	44.867	34.356	39.282	32.40
UK	London SE	107.730	106.615	120.026	129.666	134.804	139.057	132.090	126.54
US	NYSE	0.027	0.035	0.023	0.011	0.008	0.003	NA	0.02

Source: Calculated from World Federation of Exchange data

Over the period, values are calculated as (value of bond trading US$ million/GDP Current US$ million) *100. Average is the (average value of bond trading over the period 2001-2007/average GDP for the same period) *100. For France and the US, the values of bond trading are not available for the year 2001 and 2007 respectively. So their average values do not include these two years respectively.

Figure A1: ACF and PACF of Rates of Return of Different Market Segments: 1997 (1) - 2007 (7)

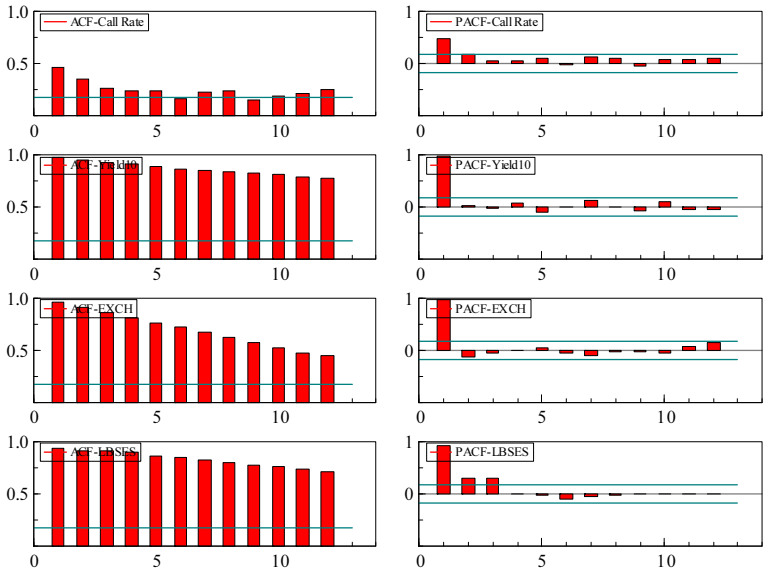

Table A4: Johansen and Juselius (J-J) Cointegration Tests for three Major Indian Financial Markets: 1997 (1) - 2007 (7)

A4.1. Variables: Call rate, Yield10, EXCH, LBSES

Null Hypothesis H_0	Trace test		Maximum Eigen Value Test	
	Alternative	Statistics[Prob]	Alternative	Statistics[Prob]
r=0	r=1	123.22 [0.000]**	r>=1	88.48 [0.000]**
r<=1	r=2	34.74 [0.012]*	r>=2	22.32 [0.032]*
r<=2	r=3	12.42 [0.139]	r>=3	9.75 [0.233]
r<=3	r=4	2.66 [0.103]	r>=4	2.66 [0.103]

A4.2. Variables: Call rate, Yield10, EXCH

Null Hypothesis H_0	Trace test		Maximum Eigen Value Test	
	Alternative	Statistics[Prob]	Alternative	Statistics[Prob]
r=0	r=1	98.08 [0.000]**	r>=1	83.15 [0.000]**
r<=1	r=2	14.93 [0.059]	r>=2	12.45 [0.094]
r<=2	r=3	2.48 [0.115]	r>=3	2.48 [0.115]

A4.3. Variables: Call rate, Yield10, LBSES

Null Hypothesis H_0	Trace test		Max test	
	Alternative	Statistics[Prob]	Alternative	Statistics[Prob]
r=0	r=1	82.69 [0.000]**	r>=1	64.90 [0.000]**
r<=1	r=2	17.79 [0.021]*	r>=2	13.97 [0.054]
r<=2	r=3	3.82 [0.051]	r>=3	3.82 [0.051]

A4.4. Variables: Call rate, EXCH, LBSES

Null Hypothesis H_0	Trace test		Max test	
	Alternative	Statistics[Prob]	Alternative	Statistics[Prob]
r=0	r=1	75.20 [0.000]**	r>=1	57.06 [0.000]**
r<=1	r=2	18.15 [0.018]*	r>=2	15.53 [0.029]*
r<=2	r=3	2.61 [0.106]	r>=3	2.61 [0.106]

A4.5. Variables: Yield10, EXCH, LBSES

Null Hypothesis H_0	Trace test		Max test	
	Alternative	Statistics[Prob]	Alternative	Statistics[Prob]
r=0	r=1	42.08 [0.001]**	r>=1	29.95 [0.001]**
r<=1	r=2	12.13 [0.152]	r>=2	9.62 [0.243]
r<=2	r=3	2.51 [0.113]	r>=3	2.51 [0.113]

A4.6. Variables: Call rate, Yield10

Null Hypothesis H_0	Trace test		Max test	
	Alternative	Statistics[Prob]	Alternative	Statistics[Prob]
r=0	r=1	62.75 [0.000]**	r>=1	59.10 [0.000]**
r<=1	r=2	3.65 [0.056]	r>=2	3.65 [0.056]

A4.7. Variables: Call rate, EXCH

Null Hypothesis H_0	Trace test		Max test	
	Alternative	Statistics[Prob]	Alternative	Statistics[Prob]
r=0	r=1	42.01 [0.000]**	r>=1	36.50 [0.000]**
r<=1	r=2	5.50 [0.019]*	r>=2	5.50 [0.019]*

A4.8. Variables: Call rate, LBSES

Null Hypothesis H_0	Trace test		Max test	
	Alternative	Statistics[Prob]	Alternative	Statistics[Prob]
r=0	r=1	51.26 [0.000]**	r>=1	48.34 [0.000]**
r<=1	r=2	2.92 [0.087]	r>=2	2.92 [0.087]

A4.9. Variables: Yield10, EXCH

Null Hypothesis H_0	Trace test		Max test	
	Alternative	Statistics[Prob]	Alternative	Statistics[Prob]
r=0	r=1	17.07 [0.027]*	r>=1	14.74 [0.040]*
r<=1	r=2	2.33 [0.127]	r>=2	2.33 [0.127]

cont'd.....

A4.10. Variables: Yield10, LBSES

Null Hypothesis H_0	Trace test		Max test	
	Alternative	Statistics[Prob]	Alternative	Statistics[Prob]
r=0	r=1	18.30 [0.017]*	r>=1	14.67 [0.041]*
r<=1	r=2	3.63 [0.057]	r>=2	3.63 [0.057]

A4.11. Variables: EXCH, LBSES

Null Hypothesis H_0	Trace test		Maximum Eigen Value Test	
	Alternative	Statistics[Prob]	Alternative	Statistics[Prob]
r=0	r=1	21.18 [0.005]**	r>=1	18.57 [0.008]**
r<=1	r=2	2.61 [0.106]	r>=2	2.61 [0.106]

Source: Calculated from the data base of RBI, Handbook of Monetary Statistics of India.

Table A5: Johansen and Juselius (J-J) Cointegration Tests for Call Money Market Rates: 1990 (1) – 2007 (7)

A5.1. Variable: Call Money Rate

Country	Null Hypothesis H_0	Trace test		Max test	
		Alternative	Statistics[Prob]	Alternative	Statistics[Prob]
Canada, India	r=0	r=1	**73.37 [0.000]****	r>=1	**64.03 [0.000]****
	r<=1	r=2	**9.34 [0.002]****	r>=2	**9.34 [0.002]****
Germany India	r=0	r=1	67.41 [0.000]**	r>=1	65.21 [0.000]**
	r<=1	r=2	2.20 [0.138]	r>=2	2.20 [0.138]
Italy, India	r=0	r=1	72.76 [0.000]**	r>=1	69.81 [0.000]**
	r<=1	r=2	2.95 [0.086]	r>=2	2.95 [0.086]
Japan, India	r=0	r=1	**70.21 [0.000]****	r>=1	**63.10 [0.000]****
	r<=1	r=2	**7.11 [0.008]****	r>=2	**7.11 [0.008]****
Korea, India	r=0	r=1	57.84 [0.000]**	r>=1	55.65 [0.000]**
	r<=1	r=2	2.18 [0.139]	r>=2	2.18 [0.139]
UK, India	r=0 r<=1	r=1 r=2	**65.84 [0.000]**** **8.65 [0.003]****	r>=1 r>=2	**57.19 [0.000]**** **8.65 [0.003]****
US, India	r=0	r=1	64.01 [0.000]**	r>=1	60.70 [0.000]**
	r<=1	r=2	3.31 [0.069]	r>=2	3.31 [0.069]

cont'd.....

A5.2. Variable: Call Money Rate

Country	Null Hypothesis H_0	Trace test		Max test	
		Alternative	Statistics[Prob]	Alternative	Statistics[Prob]
Canada, India, Germany	r=0	r=1	**100.08 [0.000]****	r>=1	**69.79 [0.000]****
	r<=1	r=2	**30.29 [0.000]****	r>=2	**21.31 [0.003]****
	r<=2	r=3	**8.99 [0.003]****	r>=3	**8.99 [0.003]****
Canada,India, Italy	r=0	r=1	92.41 [0.000]**	r>=1	77.62 [0.000]**
	r<=1	r=2	14.79 [0.062]	r>=2	9.46 [0.255]
	r<=2	r=3	5.33 [0.021]*	r>=3	5.33 [0.021]*
Canada, India, Japan	r=0	r=1	**100.95 [0.000]****	r>=1	**75.33 [0.000]****
	r<=1	r=2	**25.62 [0.001]****	r>=2	**16.28 [0.022]***
	r<=2	r=3	**9.34 [0.002]****	r>=3	**9.34 [0.002]****
Canada, India, Korea	r=0	r=1	84.71 [0.000]**	r>=1	71.01 [0.000]**
	r<=1	r=2	13.71 [0.091]	r>=2	10.79 [0.168]
	r<=2	r=3	2.92 [0.087]	r>=3	2.92 [0.087]
Canada, India, UK	r=0	r=1	**92.00 [0.000]****	r>=1	**64.85 [0.000]****
	r<=1	r=2	**27.15 [0.000]****	r>=2	**17.18 [0.015]***
	r<=2	r=3	**9.97 [0.002]****	r>=3	**9.97 [0.002]****

cont'd.....

Canada, India, US	r=0	r=1	90.45 [0.000]**	r>=1	67.89 [0.000]**
	r<=1	r=2	22.57 [0.003]**	r>=2	21.19 [0.003]**
	r<=2	r=3	1.37 [0.241]	r>=3	1.37 [0.241]
Japan, India, Germany	r=0	r=1	**116.45 [0.000]****	r>=1	**65.77 [0.000]****
	r<=1	r=2	**50.68 [0.000]****	r>=2	**43.96 [0.000]****
	r<=2	r=3	**6.71 [0.010]****	r>=3	**6.71 [0.010]****
Japan, India, Italy	r=0	r=1	94.80 [0.000]**	r>=1	72.30 [0.000]**
	r<=1	r=2	22.50 [0.003]**	r>=2	19.92 [0.005]**
	r<=2	r=3	2.57 [0.109]	r>=3	2.57 [0.109]
Japan, India, Korea	r=0	r=1	83.73 [0.000]**	r>=1	65.03 [0.000]**
	r<=1	r=2	18.70 [0.014]*	r>=2	13.63 [0.061]
	r<=2	r=3	5.07 [0.024]*	r>=3	5.07 [0.024]*
Japan, India, UK	r=0	r=1	**102.95 [0.000]****	r>=1	**69.45 [0.000]****
	r<=1	r=2	**33.51 [0.000]****	r>=2	**25.30 [0.000]****
	r<=2	r=3	**8.21 [0.004]****	r>=3	**8.21 [0.004]****
Japan, India, US	r=0	r=1	**100.60 [0.000]****	r>=1	**75.55 [0.000]****
	r<=1	r=2	**25.05 [0.001]****	r>=2	**17.98 [0.011]***
	r<=2	r=3	**7.07 [0.008]****	r>=3	**7.07 [0.008]****

cont'd.....

India, Germany, UK	r=0	r=1	**107.93 [0.000]****	r>=1	**65.27 [0.000]****
	r<=1	r=2	**42.66 [0.000]****	r>=2	**36.53 [0.000]****
	r<=2	r=3	**6.13 [0.013]***	r>=3	**6.13 [0.013]***
India, Italy, UK	r=0	r=1	86.29 [0.000]**	r>=1	71.51 [0.000]**
	r<=1	r=2	14.79 [0.062]	r>=2	9.68 [0.239]
	r<=2	r=3	5.11 [0.024]*	r>=3	5.11 [0.024]*
India, Korea, UK	r=0	r=1	76.86 [0.000]**	r>=1	61.40 [0.000]**
	r<=1	r=2	15.46 [0.049]*	r>=2	12.79 [0.084]
	r<=2	r=3	2.67 [0.102]	r>=3	2.67 [0.102]
India, US, UK	r=0	r=1	96.07 [0.000]**	r>=1	62.68 [0.000]**
	r<=1	r=2	33.40 [0.000]**	r>=2	31.37 [0.000]**
	r<=2	r=3	2.03 [0.155]	r>=3	2.03 [0.155]

A5.3. Variable: Call Money Rate

Country	Null HypothesisH_0	Trace test		Max test	
		Alternative	Statistics[Prob]	Alternative	Statistics[Prob]
Canada, India, Germany, Japan	r=0	r=1	**146.69 [0.000]****	r>=1	75.46 [0.000]**
	r<=1	r=2	**71.23 [0.000]****	r>=2	54.87 [0.000]**
	r<=2	r=3	**16.36 [0.035]***	r>=3	11.59 [0.128]
	r<=3	r=4	**4.77 [0.029]***	r>=4	4.77 [0.029]*

cont'd.....

Canada, India, UK,Japan	r=0	r=1	**127.78 [0.000]****	r>=1	**77.10 [0.000]****
	r<=1	r=2	**50.68 [0.000]****	r>=2	**25.75 [0.009]****
	r<=2	r=3	**24.92 [0.001]****	r>=3	**15.01 [0.036]***
	r<=3	r=4	**9.91 [0.002]****	r>=4	**9.91 [0.002]****
Canada, India, Germany, UK	r=0	r=1	**133.42 [0.000]****	r>=1	**70.81 [0.000]****
	r<=1	r=2	**62.61 [0.000]****	r>=2	**37.69 [0.000]****
	r<=2	r=3	**24.91 [0.001]****	r>=3	**14.19 [0.049]***
	r<=3	r=4	**10.73 [0.001]****	r>=4	**10.73 [0.001]****
Canada, India, Germany, US	r=0	r=1	**132.84 [0.000]****	r>=1	**71.82 [0.000]****
	r<=1	r=2	**61.02 [0.000]****	r>=2	**30.52 [0.001]****
	r<=2	r=3	**30.50 [0.000]****	r>=3	**23.21 [0.001]****
	r<=3	r=4	**7.29 [0.007]****	r>=4	**7.29 [0.007]****
Canada, India, Japan, US	r=0	r=1	120.71 [0.000]**	r>=1	79.48 [0.000]**
	r<=1	r=2	41.24 [0.001]**	r>=2	21.37 [0.044]*
	r<=2	r=3	19.86 [0.009]**	r>=3	16.51 [0.020]*
	r<=3	r=4	3.36 [0.067]	r>=4	3.36 [0.067]
Canada, India, UK, US	r=0	r=1	116.20 [0.000]**	r>=1	68.74 [0.000]**
	r<=1	r=2	47.46 [0.000]**	r>=2	31.83 [0.001]**
	r<=2	r=3	15.63 [0.046]*	r>=3	13.74 [0.059]
	r<=3	r=4	1.89 [0.169]	r>=4	1.89 [0.169]

cont'd.....

A5.4. Variable: Call Money Rate

Country	Null Hypothesis H_0	Trace test		Max test	
		Alternative	Statistics[Prob]	Alternative	Statistics[Prob]
Canada, India, Germany, Japan, UK	r=0	r=1	**183.50 [0.000]****	r>=1	78.23 [0.000]**
	r<=1	r=2	**105.26 [0.000]****	r>=2	65.17 [0.000]**
	r<=2	r=3	**40.09 [0.002]****	r>=3	24.30 [0.015]*
	r<=3	r=4	**15.79 [0.044]***	r>=4	11.29 [0.142]
	r<=4	r=5	**4.50 [0.034]***	r>=5	4.50 [0.034]*
Canada, India UK,Japan, US	r=0	r=1	163.02 [0.000]**	r>=1	81.03 [0.000]**
	r<=1	r=2	81.99 [0.000]**	r>=2	46.76 [0.000]**
	r<=2	r=3	35.23 [0.010]**	r>=3	19.54 [0.083]
	r<=3	r=4	15.70 [0.045]*	r>=4	12.77 [0.084]
	r<=4	r=5	2.93 [0.087]	r>=5	2.93 [0.087]
Canada, India, UK, Germany, US	r=0	r=1	**168.70 [0.000]****	r>=1	74.30 [0.000]**
	r<=1	r=2	**94.41 [0.000]****	r>=2	45.80 [0.000]**
	r<=2	r=3	**48.61 [0.000]****	r>=3	32.19 [0.001]**
	r<=3	r=4	**16.42 [0.035]***	r>=4	11.75 [0.121]
	r<=4	r=5	**4.66 [0.031]***	r>=5	4.66 [0.031]*

cont'd.....

A5.5. Variable: Call Money Rate

Country	Null Hypothesis H_0	Trace test		Max test	
		Alternative	Statistics[Prob]	Alternative	Statistics[Prob]
Canada, India, Germany, Japan, UK, US	r=0	r=1	240.58 [0.000]**	r>=1	85.26 [0.000]**
	r<=1	r=2	155.32 [0.000]**	r>=2	68.35 [0.000]**
	r<=2	r=3	86.97 [0.000]**	r>=3	54.68 [0.000]**
	r<=3	r=4	32.29 [0.025]*	r>=4	17.64 [0.148]
	r<=4	r=5	14.65 [0.066]	r>=5	12.13 [0.106]
	r<=5	r=6	2.52 [0.113]	r>=5	2.52 [0.113]

Source: Calculated from IFS data, March 2008, and the RBI, Handbook of Monetary Statistics of India.

Figure A2: ACF and PACF of Mean Deviation of Call Money Market Rate: 1990 (1) – 2007 (7)

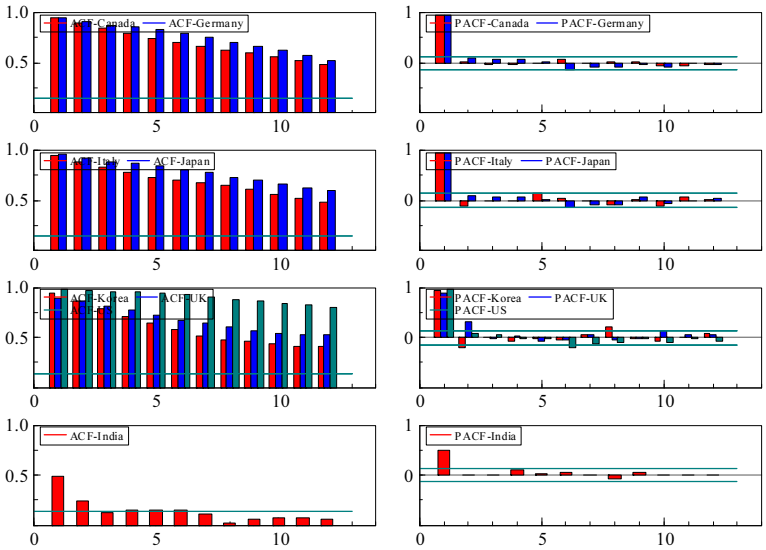

Table A6: Johansen and Juselius (J-J) Cointegration Tests for 10-Year Government Bond Yield: 1997 (1) – 2007 (7)

A6.1. Variable: 10-Year Government Bond Yield

Country	Null HypothesisH_0	Trace test		Max test	
		Alternative	Statistics[Prob]	Alternative	Statistics[Prob]
Canada, India	r=0	r=1	11.99 [0.159]	r>=1	10.06 [0.212]
	r<=1	r=2	1.94 [0.164]	r>=2	1.94 [0.164]
France,India	r=0	r=1	8.51 [0.419]	r>=1	6.09 [0.608]
	r<=1	r=2	2.42 [0.119]	r>=2	2.42 [0.119]
Germany, India	r=0	r=1	8.97 [0.375]	r>=1	6.75 [0.527]
	r<=1	r=2	2.22 [0.136]	r>=2	2.22 [0.136]
Italy, India	r=0	r=1	13.48 [0.098]	r>=1	11.97 [0.112]
	r<=1	r=2	1.51 [0.219]	r>=2	1.51 [0.219]
Japan, India	r=0	r=1	14.02 [0.081]	r>=1	10.40 [0.190]
	r<=1	r=2	3.62 [0.057]	r>=2	3.62 [0.057]
Korea, India	r=0	r=1	9.71 [0.309]	r>=1	7.71 [0.417]
	r<=1	r=2	2.00 [0.157]	r>=2	2.00 [0.157]
UK, India	r=0	r=1	11.45 [0.188]	r>=1	6.12 [0.605]
	r<=1	r=2	5.33 [0.021]*	r>=2	5.33 [0.021]*
US, India	r=0	r=1	12.74 [0.125]	r>=1	8.64 [0.324]
	r<=1	r=2	4.10 [0.043]*	r>=2	4.10 [0.043]*

cont'd.....

A6.2. Variable: 10-Year Government Bond Yield

Country	Null Hypothesis H_0	Trace test		Max test	
		Alternative	Statistics[Prob]	Alternative	Statistics[Prob]
India, UK,US	r=0	r=1	38.65 [0.003]**	r>=1	25.14 [0.011]*
	r<=1	r=2	13.51 [0.097]	r>=2	9.87 [0.225]
	r<=2	r=3	3.65 [0.056]	r>=3	3.65 [0.056]

Source: Computed from IFS data, March 2008, and the RBI Handbook of Monetary Statistics of India.

Table A7: Johansen and Juselius (J-J) Cointegration Tests for Three-Month Treasury Bill Rate: 1997 (1) – 2007 (7)

A7.1. Variable: 3-Month Treasury Bill

Country	Null Hypothesis H_0	Trace test		Max test	
		Alternative	Statistics[Prob]	Alternative	Statistics[Prob]
Canada, India	r=0	r=1	37.60 [0.000]**	r>=1	36.70 [0.000]**
	r<=1	r=2	0.90 [0.344]	r>=2	0.90 [0.344]
India, UK	r=0	r=1	35.31 [0.000]**	r>=1	34.08 [0.000]**
	r<=1	r=2	1.24 [0.266]	r>=2	1.24 [0.266]

A7.2. Variable: 3-Month Treasury Bill

Country	Null Hypothesis H_0	Trace test		Max test	
		Alternative	Statistics[Prob]	Alternative	Statistics[Prob]
Canada, India, UK,	r=0	r=1	67.60 [0.000]**	r>=1	55.66 [0.000]**
	r<=1	r=2	11.94 [0.162]	r>=2	9.23 [0.273]
	r<=2	r=3	2.71 [0.100]	r>=3	2.71 [0.100]

Source: Computed from IFS data, March 2008, and the RBI, Handbook of Monetary Statistics of India.

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