

3-1-2018

Co-Integration Between Savings and Investment in India and the US: An Econometric Analysis of Feldstein-Horioka Hypothesis

Narender Thakur Ph.D.
University of Delhi, narender224jnu@gmail.com

Vishnu Das Gupta

Follow this and additional works at: <https://digitalcommons.du.edu/irbe>



Part of the [Business Commons](#), and the [Economics Commons](#)

Recommended Citation

Thakur, Narender Ph.D. and Gupta, Vishnu Das (2018) "Co-Integration Between Savings and Investment in India and the US: An Econometric Analysis of Feldstein-Horioka Hypothesis," *International Review of Business and Economics*: Vol. 2: Iss. 1, Article 1.

Available at: <https://digitalcommons.du.edu/irbe/vol2/iss1/1>

This Article is brought to you for free and open access by Digital Commons @ DU. It has been accepted for inclusion in International Review of Business and Economics by an authorized editor of Digital Commons @ DU. For more information, please contact jennifer.cox@du.edu, dig-commons@du.edu.

9. CO-INTEGRATION BETWEEN SAVINGS AND INVESTMENT IN INDIA AND THE US: AN ECONOMETRIC ANALYSIS OF FELDSTEIN-HORIOKA HYPOTHESIS

NARENDER THAKUR, *Assistant Professor, Department of Economics, BR Ambedkar College, University of Delhi. Email: narender224jnu@gmail.com.*

VISHNU DAS GUPTA, *Independent Researcher*

ABSTRACT

This paper econometrically tests the Feldstein-Horioka hypotheses. It uses the domestic savings and domestic investments variables in India and the US in the period 1960-2014. The Feldstein-Horioka hypotheses states that the cointegration relationship between domestic savings and domestic investments weakens in a country with higher foreign capital mobility and vice-versa. We find that the co-integration relation between the two time-series variables is weakened in the case of the US economy as compared to the Indian economy. These results have policy implications for India as it is opening itself up more to inward foreign investment.

KEYWORDS: *Feldstein-Horioka Hypotheses, Savings, Investment, Capital Mobility, India and US*

JEL Classification: E21, E22, F21

INTRODUCTION

With increased integration of the global economy over the past quarter century and the liberalization of the emerging markets over roughly the same time period, questions arise on the role domestic savings play in driving domestic investment in light of increased access to global markets.

The Feldstein-Horioka hypothesis states that over a period of time, the relationship between domestic investment and domestic savings weakens. In other words, in a perfectly open economy, the relationship between domestic-saving and domestic investment weakens and it tends to zero and in a perfectly closed economy, this

* **VISHNU DAS GUPTA**, Independent Researcher would like to thank **JHANVI TRIPATHI** for her useful suggestions.

relationship tends towards unity. The relationship is defined in terms of co-integration between the two variables, viz., domestic savings and domestic investment (Coakley, Kulasi and Smith, 1996).

We test this hypothesis that is the co-integration between the domestic savings and investment through a time series analysis of two countries, the United States of America (USA/US) and India. It is a common assumption that the Indian economy is a relatively less open economy viz-a-viz the US economy. The paper shows the relative importance of foreign capital in a domestic economy, given the increasingly open nature of economies globally.

We place the paper in the context of whether large inflows of foreign capital are required for economic growth in a country or should steps be taken to encourage higher domestic savings and encourage firms to be more reliant on domestic capital.

This paper is divided into four sections. The first section briefly surveys the literature, with the second section includes data, econometric method, and empirical results. The third section is on the long-run relationship between savings and investments in India and US, and lastly section four concludes. We also list the unit root results in the appendix.

REVIEW OF LITERATURE

Bai and Zhang (2010) in their paper solve the FH puzzle by introducing two types of financial frictions - limited enforcement and limited spanning. The first one refers to - contracts being enforced by the threat of default penalties. The second one happens when the only asset available is non-contingent bonds. They find that the combination of limited enforcement friction by having low default penalties (under which capital flows are much lower than those in the data), and limited spanning friction which has to (exogenously) restrict capital flows to the observed level endogenously tends to restrict capital flows and solves the Feldstein-Horioka puzzle.

Khundrakpam and Ranjan (2010) in their paper focus on the FH puzzle with respect to India by analysing the relationship between domestic savings and domestic investment in both the pre and post reform period. They find that in the long run savings rate tends to influence the investment rates without any feedback. However they also observe that the relationship between savings and investment (though statistically significant) appears weaker in the post reform period.

Coakley, Kulasi, and Smith (1996) suggested an alternate explanation to the strong cross section findings in FH (1980). They showed through a theoretical model with econometric evidence that related the saving-investment behaviour to the current account (via a solvency constraint and not by endogenous government policy). In their empirical model they attempted this by an error correction mechanism (proxying a market-determined risk premium on borrowing). The results and their explanation of the same in the paper solves the puzzle of a continuing high association between saving and investment despite the presence of high capital mobility.

Adedeji & Thornton (2007) however show us that there are differences between the saving-retention ratios between economies despite the fact that savings and investment are cointegrated. Ma & Li (2016) in their investigation of the FH puzzle found that savings-retentions coefficients tends to vary over time but they tend to generally be higher in developed countries than developing countries.

DATA, ECONOMETRIC METHODS AND EMPIRICAL RESULTS

The data for the study was taken from the World Development Indicators of the World Bank. The time period of the study is 1960 to 2014. For both India and the USA we report the Gross Capital Formation & Gross Domestic Savings. All the variables have been deflated by their respective Consumer Price Index (CPI) [CPI, 2010=100]. We initially run the Augmented Dicky Fuller Tests (ADF) to check for unit roots of the time series variables; and with all the variables possessing unit root we test the hypothesis for the two respective countries.

To investigate the long run relationship (if any exist) between gross capital formation(or alternatively gross investment) and gross domestic savings we first run a Dynamic Ordinary Least Squares (OLS) model for both the Countries and then run the Engle Granger co-integration test to check whether the series are co-integrated or not. The results for both India and the USA are given in Tables 1, 2 & 3.

Table 1: India

Variable	Coefficient	Std. Error	t-Statistic	P value
Gross Domestic Savings	1.082986	0.031973	33.87196	0.0000
Constant	-0.390597	0.179869	-2.171558	0.0346

R-squared - 0.982940

Table 2: USA

Variable	Coefficient	Std. Error	t-Statistic	P value
Gross Domestic Savings	1.286962	0.050947	25.26062	0.0000
Constant	-2.077303	0.384482	-5.402863	0.0000

R-squared - 0.976183

Table 3: Engle Granger Co-integration Test

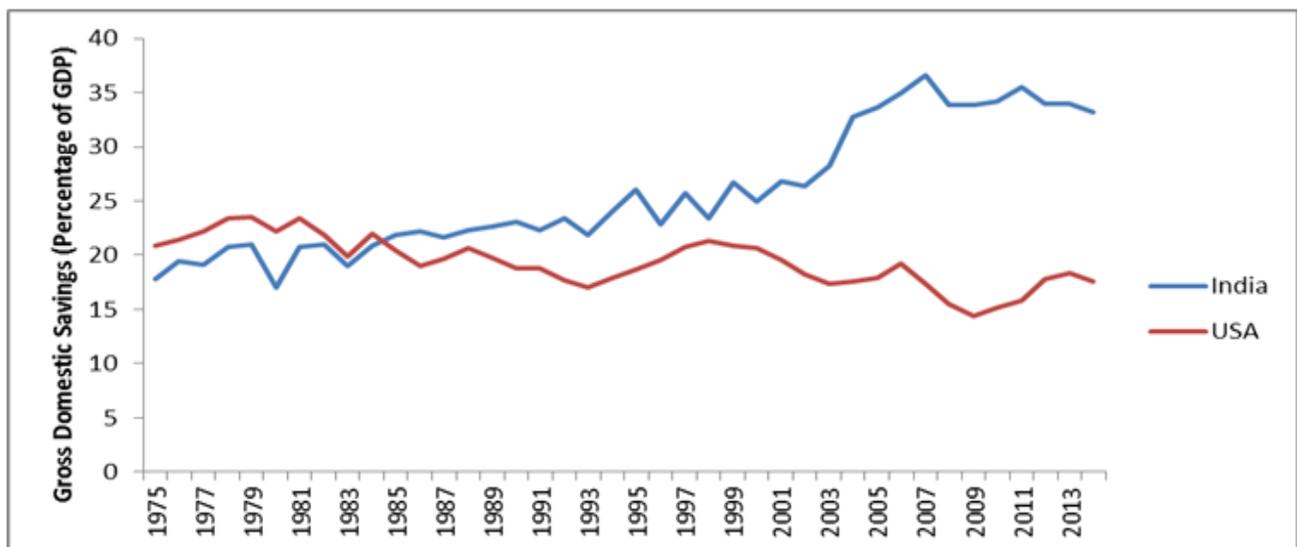
Country	Engle Granger tau-statistic	Prob.*
India	-3.732792	0.0259
USA	-2.111048	0.4762

*MacKinnon (1996) p-values.

We can observe in Table 3 that for India the variables are co integrated whereas for the US (Table 4) they appear to not be co integrated. Two possible explanations can be offered for this.

The first is that savings in India is comparably more than the USA, thereby allowing firms a larger share of domestic funds vis-à-vis the USA. The gross domestic savings as a percentage of GDP for both the countries is given in Figure 1.

Figure 1: Gross Domestic Savings (Percentage of GDP)



Source: World Development Indicators 2016

The figure shows us that (barring the odd 2-3 years), India’s gross domestic savings as a percentage of GDP are consistently higher than that of the USA. The greater access to domestic funds for Indian firms vis-à-vis US firms may be a possible reason for the co-integration between the Indian variables and no co-integration for the USA variables.

The second reason for the result may be the nature of the respective economies by themselves. While India has initiated several economic reforms and has opened up, it still remains a closed economy on a comparative basis. The USA is among the most developed economies in the world and, compared to India and several other developing economies, has a simpler and faster process for inward investment.

As we can see in Figures 2, 3, and 4 the level of foreign capital in domestic capital formation is higher in the USA as compared to India.

Figure 2: FDI Inflows (India & USA) Source: United Nations Conference on Trade and Development

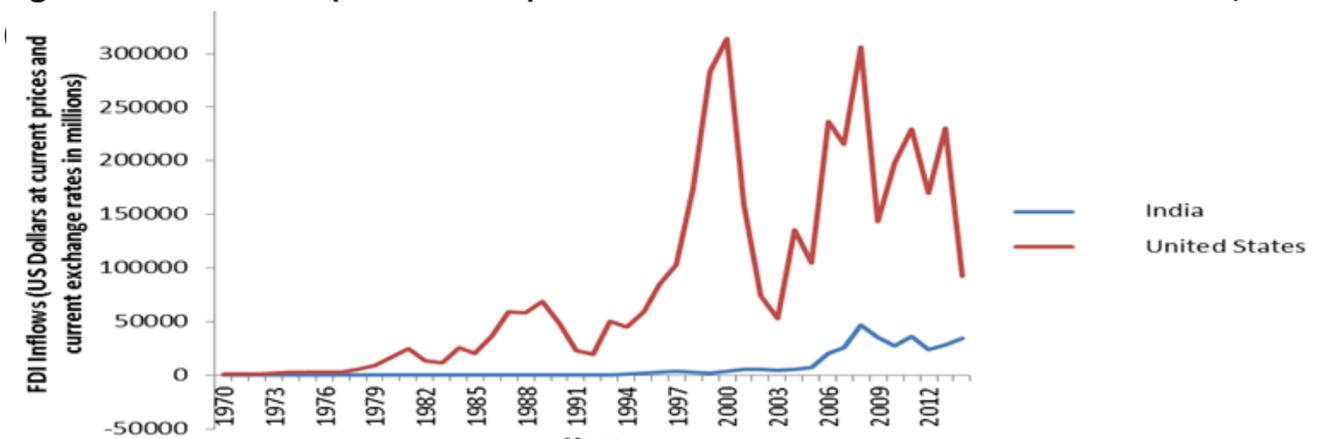
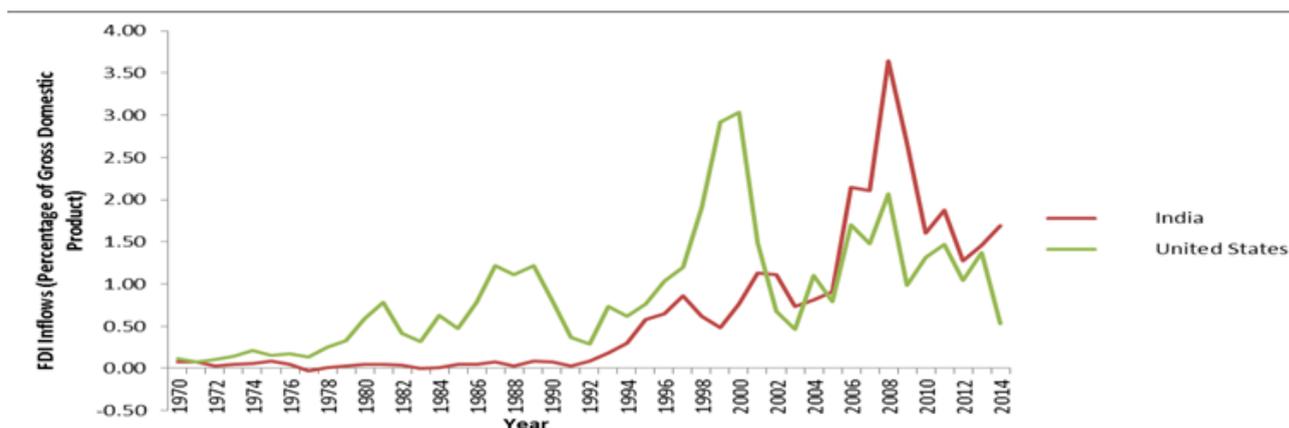
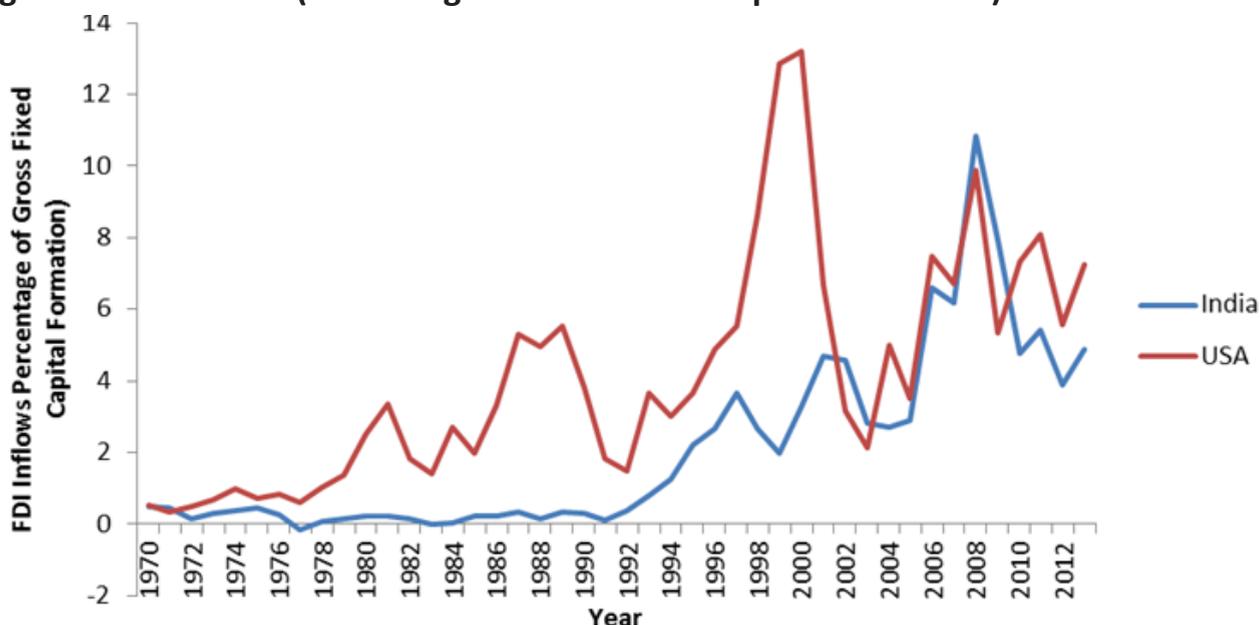


Figure 3: FDI Inflows (Percentage of Gross Domestic Product)



Source: United Nations Conference on Trade and Development (UNCTAD)

Figure 4: FDI Inflows (Percentage of Gross Fixed Capital Formation)



Source: United Nations Conference on Trade and Development (UNCTAD)

While Figure 3 shows us that the percentage share of FDI in GDP is higher in India than that of the US, it is still quite small in terms of its absolute number of volume as compared to that of the USA (Figure 2).

What is of interest, and goes some way in reinforcing our results, is the share of FDI inflows as a percentage of Gross Fixed Capital Formation (GFCF) in both the countries (Figure 4). As a percentage share of GFCF, FDI inflows occupy a larger share in the USA than in India. This corresponds with the large FDI inflows in absolute numbers (Figure 2). This provides an explanation for the lack of co-integration between Gross Domestic Investment and Gross Domestic Savings in the US (as shown in Table 3).

Another factor is the level of technological advancement, infrastructure, and the diversity in investment opportunities. These will be higher in the US than India thereby opening up more channels of foreign investment for the former.

We would also like to point out the effect Foreign Portfolio Investments (FPI) may have on the relationship between domestic savings and investments. A greater flow of

FPI may weaken the link between domestic savings and investment. For example, as of December 2015 the USA has attracted a total of US \$ 9.45 trillion of total portfolio investment assets as compared to India where it stands at US \$ 1.56 trillion (within the same time period) . We presume the reason for this trend is quite similar to those listed before in the paper, i.e. the USA is a more attractive investment destination than India.

The above explanations may be among the reasons why domestic investment still plays such a valuable role in India. In the USA, while it still plays a role, the importance has diminished as the country is better connected to the global economy. This facilitates a smoother inflow of foreign capital in the USA as compared to many other countries.

These observations raise a few important questions. In light of recent events in the global economy should a domestic economy be more open to foreign investments? Or should domestic savings be encouraged and domestic firms have a preference for domestic capital? There have also been some questions raised on the relative importance of foreign capital if it leads to increased volatility in the market. However, having greater access to capital (both domestic and foreign) might enable firms (both old and new) to deepen their capital base, boost productivity and expand production and maybe even access outside expertise.

There are no easy answers to these. What we can offer is this – The policymaker while formulating the policy should understand the existing structure of the economy and ask if having greater access to capital would be beneficial for overall economic growth and development.

LONG-RUN RELATIONSHIP BETWEEN SAVINGS AND INVESTMENTS IN INDIA AND US

On the nature of the long run relationship for India, we find that the relation between the gross fixed capital formation and domestic savings is strong and statistically significant (Table 1).

For every 1 per cent increase in domestic savings, the gross fixed capital formation rises by slight more than 1 per cent. This strong result indicates the importance domestic savings have for investment and capital formation in India. In the long run, an economy where domestic savings are encouraged will be conducive for capital development and lead to greater stocks of capital which can only boost the economic growth in the country.

What about the short run relationship between savings and capital formation? We run an OLS regression with the error correcting mechanism on the relationship between the first differences of gross fixed capital formation and gross domestic savings in the Indian economy .

We initially run a model with up to 2 lags for both the first difference of the gross fixed capital formation and gross domestic savings and a lag of the error correcting variable. To get the most parsimonious model we remove the insignificant variables

(those with the largest p values) until we get a parsimonious model with all the significant variables. The result is given in Table 4.

Table 4: India [Error Correcting Model (ECM)]

Variable	Coefficient	Std. Error	t-Statistic	P value
GDS	0.952522	0.032052	29.71847	0.0000
GDS (-1)	0.077725	0.031570	2.462032	0.0175
GDS (-2)	0.084698	0.032107	2.637962	0.0112
Residuals (-1)	-0.336881	0.100466	-3.353178	0.0016

R-squared 0.953119

From the India ECM model, we observe that all the three savings variables have a positive and significant effect on gross capital formation. This is expected as past savings play a crucial role in present investment. We next observe that the error correcting variable stands around 34 per cent implying that deviations (disequilibrium/shock) from equilibrium are corrected in each year (if these were positive they would be compounded). We subject the India ECM to serial correlation and heteroskedasticity test to ensure the regression remains the Best Linear Unbiased Estimator (BLUE) for us. The results are given in Table 5.

Table 5: Heteroskedasticity & Serial Correlation Tests

Test	F-statistic	Prob. F
Breusch-Godfrey Serial Correlation LM Test	0.221837	0.8019
Breusch-Pagan-Godfrey Heteroskedasticity Test	1.695275	0.1669

As is evident the lack of any serial correlation and heteroskedasticity affirms that the India ECM model is robust and (within the model specifications) adequately captures the short run relationship between capital formation and domestic savings.

CONCLUSION

This paper is an attempt to understand the relationship between domestic savings and capital formation in two different countries over a long time period. More specifically, it tested the Fieldsten-Horioka hypothesis for both India and the USA over a longer duration of time.

We found that while a co-integrating relationship between domestic capital formation and domestic savings in India does exist, no such co-integrating relationship exists for the USA. The reason we offered for this is linked to the relative openness and structure of the respective domestic economies coupled with the level of domestic savings in the respective economies. India (despite rapid progress over the last two and half decades) still remains a relatively closed economy compared to many in the developed world. The country also contains many regulatory hurdles as is evident in its ease of doing business indicators. The USA (compared to many other economies) is quite open, has good quality infrastructure, many avenues for investment, and easier

facilitation of inward capital. All these factors among others have contributed to the weakening of the relationship between domestic capital formation and domestic savings in the USA. The US economy also has greater access to international capital as compared to the Indian economy. This too may be a contributing factor in our results. This is in line with the Fieldsten-Horioka hypothesis.

Going forward, as the world becomes increasingly globalized and global capital flowing smoother, we may expect a similar trend among other economies (including India). However this also depends on the restrictions faced by inward capital, the predictability and stability of the domestic regime and its attractiveness as an investment destination.

The recent steps taken by India in terms of bettering its Ease of Doing Business rankings and launching programs such as Make in India, Digital India, Start-up policy and Skill India attempt to ensure that the country becomes an attractive investment destination. This in turn will increase investments and aid economic growth.

There is also a critical policy implication as India is becoming more open. To the extent inward foreign capital is allowed in to help the domestic economy grow, the liberalization should be structured in a way that the domestic economy is not immensely affected by turmoil in global markets. This is an important avenue for research for future studies.

REFERENCES

1. Adedeji, Olumuyiwa & Thornton, John. *International capital mobility: Evidence from panel cointegration tests. Economics Letters*, Vol.99, pp.349–352
2. Bai, Y., Zhang, J., 2010. *Solving the Feldstein–Horioka puzzle with financial frictions. Econometrica*, 78, 603–632.
3. Coakley, J., Kulasi, F., Smith, R., 1996. *Current account solvency and the Feldstein–Horioka puzzle. Economic Journal*. 106, 620–627.
4. Feldstein, M., Horioka, C., 1980. *Domestic saving and international capital flows. Econ. J.* 90, 314–329.
5. *International Monetary Fund’s Coordinated Portfolio Investment Survey (CPIS)*
6. Khundrakpam, Jeevan K. and Ranjan, Rajiv (2010). *Saving-Investment Nexus and International Capital Mobility in India: Revisiting Feldstein-Horioka Hypothesis. Indian Economic Review, New Series, Vol. 45, No. 1 (January-June), pp. 49-66.*
7. Ma, Wei & Li, Haiqi (2016). *Time-varying saving–investment relationship and the Feldstein–Horioka puzzle. Economic Modelling*, Vol.53, pp.166–178
8. UNCTADstat, *United Nations Conference on Trade and Development (UNCTAD) Statistics. World Development Indicators 2016, The World Bank.*

Appendix

ADF Tests

India, Gross Capital Formation, logs

Null Hypothesis: INDGCF has a unit root

Exogenous: Constant, Linear Trend

Lag Length: 0 (Automatic - based on SIC, maxlag=10)

	t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic	-1.820904	0.6808
Test critical values: 1% level	-4.137279	
5% level	-3.495295	
10% level	-3.176618	

*MacKinnon (1996) one-sided p-values.

India, Gross Domestic Savings, logs

Null Hypothesis: INDGDS has a unit root

Exogenous: Constant, Linear Trend

Lag Length: 0 (Automatic - based on SIC, maxlag=10)

	t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic	-2.019654	0.5775
Test critical values: 1% level	-4.137279	
5% level	-3.495295	
10% level	-3.176618	

*MacKinnon (1996) one-sided p-values.

USA, Gross Capital Formation, logs

Null Hypothesis: USAGCF has a unit root

Exogenous: Constant, Linear Trend

Lag Length: 1 (Automatic - based on SIC, maxlag=10)

	t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic	-3.492843	0.0505
Test critical values: 1% level	-4.140858	
5% level	-3.496960	
10% level	-3.177579	

*MacKinnon (1996) one-sided p-values.

USA, Gross Domestic Savings, Logs

Null Hypothesis: USA GDS has a unit root
 Exogenous: Constant, Linear Trend
 Lag Length: 1 (Automatic - based on SIC, maxlag=10)

	t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic	-3.438086	0.0571
Test critical values: 1% level	-4.140858	
5% level	-3.496960	
10% level	-3.177579	

*MacKinnon (1996) one-sided p-values.

India, Gross Capital Formation, 1st Difference

Null Hypothesis: DINDGCF has a unit root
 Exogenous: Constant
 Lag Length: 0 (Automatic - based on SIC, maxlag=10)

	t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic	-6.791301	0.0000
Test critical values: 1% level	-3.560019	
5% level	-2.917650	
10% level	-2.596689	

*MacKinnon (1996) one-sided p-values.

India, Gross Domestic Savings, 1st Difference

Null Hypothesis: DINDGDS has a unit root
 Exogenous: Constant
 Lag Length: 0 (Automatic - based on SIC, maxlag=10)

	t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic	-7.098603	0.0000
Test critical values: 1% level	-3.560019	
5% level	-2.917650	
10% level	-2.596689	

*MacKinnon (1996) one-sided p-values.

USA, Gross Capital Formation, 1st Difference

Null Hypothesis: DUSAGCF has a unit root

Exogenous: Constant

Lag Length: 0 (Automatic - based on SIC, maxlag=10)

	t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic	-6.276607	0.0000
Test critical values: 1% level	-3.560019	
5% level	-2.917650	
10% level	-2.596689	

*MacKinnon (1996) one-sided p-values.

USA, Gross Domestic Savings, 1st Difference

Null Hypothesis: DUSAGDS has a unit root

Exogenous: Constant

Lag Length: 0 (Automatic - based on SIC, maxlag=10)

	t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic	-6.296089	0.0000
Test critical values: 1% level	-3.560019	
5% level	-2.917650	
10% level	-2.596689	

*MacKinnon (1996) one-sided p-values.