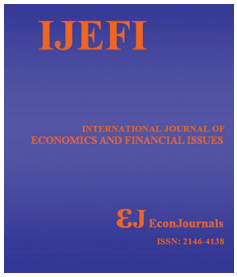

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The Relationship between Elastic Money Growth and Prices in Countries with the Largest Money Stock: An Econometric Review

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ABSTRACT

The main objective of this paper is to examine the relationship between money expansion and inflation rates and asset price fluctuations across countries charged with highest money creation. The U.S.A, India, China and Japan reported with highest money stock in the world are studied for about 55 years. This research considers the monthly data of M2, the consumer price index, stock index values and real estate values in the stated countries. Johansen's Cointegration test indicates that a long term equilibrium relationship is seen between money supply and inflation rates and money supply and asset prices in all the four countries except India where money supply is not significantly cointegrated with the asset prices. Granger causality test results offer no definite inference, in China and Japan causality is mostly not established between the variables, however in the U.S.A and India significant causal relationship is seen.

Keywords: Causality, Co-integration, Money Supply, Inflation, Asset Prices, Stock Indices, Real Estate Indices
JEL Classifications: C3, E300

1. INTRODUCTION

This paper is an attempt to validate quantitatively the theory of instability of elastic money. A stance that elastic nature of fiat money is mainly responsible for inflation and Asset Price fluctuations is maintained and tested via Granger causality tests and Johansen's Co-integration Tests. Four countries namely Japan, the U.S.A, India and China, due to their leading money supply figures, have been selected to carry out this analysis. The study period is almost 55 years for all the countries except China, for which the data could not be found beyond 16 years. This research is not attempting to prove or disprove the Keynesian or Monetarist assertions towards the phenomenon of inflation. Our stance is to validate the fact that inflation which is said to eat up the value of fiat money, is only and only caused by the increased supply of it. Secondly, the Monetary impulses in the form of loose money supply put pressure on asset prices like stock and real estate prices which do not reflect the investor preferences but the easy money that has found its way into such markets. Therefore, this research would test the causality and co-integration between money supply growth and inflation and asset prices.

The empirical analysis of the relationship between money supply and prices, and money supply and asset prices has received much attention in the past few decades. Most of the studies conducted, attempt to validate or refute the quantity theory of money. As price stability has remained one of the overriding objectives of the monetary policy, many scholars have attempted to approach the money price relationship to ascertain whether the objective is achieved or not. This empirical study will embrace the approach of validating the ill effects of fiat money systems in terms of deterioration of people's purchasing power and the creation of asset price bubbles.

2. LITERATURE REVIEW

Not many studies are conducted to investigate the causality between money supply and prices for a sample of countries that have higher money growth, however many researches have been conducted to study the individual countries for the same.

The single country analyses of similar studies have yielded the mixed results. For example, Dave and Rami (2008) studied the causality between money supply and price level in India for the time period 1953-2005 using monthly data. The results show that the money is endogenous and it is partially determined by the price level. Similarly the results also show that the monetary policy in India with respect to the money supply only have limited impact on the inflation, and main reason behind the increase in the rate of inflation in India is due to increase in the money supply.

Ma and Sun (2004) investigated the relationship between the money and price relationship in China. By using the Granger causality test, the authors tried to examine two aspects of the price level, namely the inflation and deflation. The empirical study suggested that the money in China was endogenous during the period of inflation.

Emerson (2006) examined the validity of the quantity theory of money in case of the United States from 1959 to 2004. The main aim of this study was to find out the relationship between prices, money, interest and output in the long run. The long term relationship among the variables was studied via co-integration analysis using the Johansen test and the Augmented Dickey Fuller (ADF) unit root test was employed to test for the stationarity. The results showed that price levels in the United States are affected by the money supply; however no long term association between money and prices is seen.

Katrin et al. (2008), studied prices and inflation in Japan in various time horizons and determined that the causality runs from money to the prices.

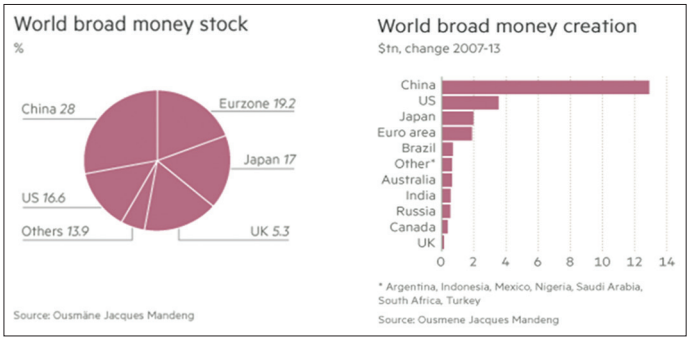
Sharma et al. (2008) in their study in India examined the causality between prices, output and money in India. Using the bivariate methodology to test the Granger causality between prices level, money supply and output (using frequency domain), the authors concluded that the there is money-output trade-off in the short run however in the long run money supply have impact on the price level but not on the output.

Diaz and Kirkby (2013) examined the quantity theory of money in case of United States for the period 1960-2009. The results show that the quantity theory of money holds in the long run during the 1960-2009 which means that the money supply in United States has long run impact on the price level. However in the short run the relationship does not hold during the study period.

Gerlach (1995) tried to test the quantity theory of money using the long run averaged data across various countries. This paper was aimed at finding the relationship between the long run average inflation, real income growth and the money growth. The study concluded that the findings of a one to one relationship of inflation and money growth is sensitive with respect to the inclusion of the data from some countries which have very high rate of inflation.

Studies related to the relationship between increase in the money supply and asset prices, show mixed results. Arif et al. (2012)'s study aimed to test the linkage between money supply, liquidity, share price and interest rate on quarterly data from 1968 to 2011. The results show that the changes in the money supply have positive effect on the liquidity and this result is in line with the existing theory. The authors also extend the liquidity equation to the price of the assets where the results show that the changes in the liquidity also have positive effect on the prices of the shares controlling for the earning effect.

Figure 1: World broad money statistics



Yao et al. (2011)'s study was based on China between June 2005 and September 2010 and the authors examined the effect of the monetary policy on the asset prices using the monthly data. Using the Johansen co-integration method based on Granger causality and the vectors autoregressive (VAR), the results showed that monetary policies in China have little impact on the asset prices in the short run.

Other studies of this nature have been carried out in countries like Malaysia, Pakistan, Nigeria and Australia, showing either the causality or long-term equilibrium relationship between Money supply growth and asset prices.

3. DATA AND METHODOLOGY

This study examines the causality and long-term relationship in terms of cointegration between money supply and general prices, money supply and asset prices. The countries selected to test this causality are the United States of America, Japan, China and India. The reason this research has selected the U.S.A, China and Japan is that these stand as world's largest economies and their Central Banks are charged with chasing high money supply growth. As reported by the Financial Times (2015), China's broad money supply within 2007-2013 has outgrown the rest of the world. Johnson (2015) in Financial Times as indicated in the Figure 1, listed countries in accordance to their broad money creation, China, United States and Japan topped the list. These countries even contribute in major proportions to the world broad money stock, Johnson (2015 FT). India, though not as advanced in money creation as other three, still tops the list of emerging economies with very high money growth. It is thought to be intriguing to explore the causal relation between money supply and prices in these countries where money supply has been continuously on the rise. Additionally like the United States and Japan, China's surge in money supply is seen to fuel bubbles in its real estate and stock markets. With this pre-consideration, the research aims at uncovering rather validating the ill effects of increased fiat money

supply on prices in general (the purchasing power of the common man) and on asset prices in the U.S.A, Japan, China and India.

The monthly data of broad money indicator M2 is collected for the United States of America, Japan, China and India. The price is taken as monthly consumer price index (CPI) data for these countries. The stock indices and real estate indices are taken as proxies for stock prices and property prices respectively. Monthly average values of Dow Jones Industrial Index, Nikkei 225, Shanghai stock exchange composite index and Sensex have been acquired for the U.S.A, Japan, China and India respectively. Monthly averages of S and P home price Index are taken as proxy for property values in the U.S.A. For Japan, India and China, property total return indices have been taken as proxies for property prices.

4. MODEL BUILDING

ADF test: Causality tests of Granger assume that the time series involved in the analysis are stationary. Therefore, tests of stationarity should precede tests of causality (Gujarati, 2004. p. 794) to rule out any possibility of Spurious, or nonsense regression, which is likely to distort the meaningfulness of the results obtained. In order to test for the stationarity, each time series acquired will go through ADF test. As in all we have 4 time series for each country i.e., monthly money supply, CPI, stock index values and property index values. All the 16 time series collected should pass through the ADF test to test for the unit root.

yt is a random walk (with no constant and linear trend):

$$\Delta yt = \delta yt-1 + \sum_i^n \alpha i \Delta yt-i+ut \quad (1)$$

yt is a random walk with drift (With constant):

$$\Delta yt = \beta 1 + \delta yt-1 + \sum_i^n \alpha i \Delta yt-i+ut \quad (2)$$

yt is a random walk with drift around a stochastic trend (With constant and linear trend):

$$\Delta yt = \beta 1 + \beta 2t + \delta yt-1 + \sum_i^n \alpha i \Delta yt-i+ut \quad (3)$$

Where t is the time or trend variable and ut is a pure white noise error term and where $\Delta yt-1 = (yt-1-yt-2)$, $\Delta yt-2 = (yt-2-yt-3)$, etc. The number of lagged difference terms to include is often determined empirically. In ADF we test whether $\delta = 0$. In each case, the null hypothesis is that $\delta = 0$; that is, there is a unit root-the time series is nonstationary. The alternative hypothesis is that $\delta < 0$; that is, the time series is stationary. The unit root test is conducted for all the four time series (money supply, CPI, stock index values and property index values) in each country under consideration. The lag length is taken in accordance to the Schwarz Information Criterion given automatically in the E-views unit root test.

4.1. Granger Causality Test

Correlation may not always refer to causation in any meaningful sense of that word. Granger (1969) approached the problem of whether x causes y by seeing how much of y is explainable by the past values of y and if adding lagged values of x improved the explanation then x is said to help in predicting the values of y, hence x is said to Granger Cause y. This is ascertained by the statistically significant value of the co-efficient of lagged x. The method of Granger Causality measures the precedence and information content but may not validate causality in a sense the word is commonly used. Is it Y that "causes" the X (Y→X) or is it the X that causes Y (X→Y), where the arrow points to the direction of causality. The Granger causality test assumes that the information relevant to the prediction of the respective variables, Y and X is contained solely in the time series data on these variables. The Granger causality models are typically put in terms of Bivariate regressions of the form,

$$yt = \alpha 0 + \sum_i^n \alpha i yt-i + \sum_i^n \beta i xt + \varepsilon t \quad (4)$$

$$xt = \alpha 0 + \sum_i^n \alpha i xt-i + \sum_i^n \beta i yt-i + ut \quad (5)$$

This research conducts the Granger causality test between the first differenced forms of "money supply and CPI," "money supply and stock index values" and "money supply and property index values" in all the four countries i.e., China, India, Japan and the U.S. This test will reveal whether it is the money supply that causes the changes in general prices and asset prices or Vice-Versa.

$$\ln MSt = \alpha 0 + \sum_i^n \alpha i \ln MSt-i + \sum_i^n \beta i \ln CPIt-i + \varepsilon t \quad (6)$$

$$\ln MSt = \alpha 0 + \sum_i^n \alpha i \ln MSt-i + \sum_i^n \beta i \ln SPt-i + \varepsilon t \quad (7)$$

$$\ln MSt = \alpha 0 + \sum_i^n \alpha i \ln MSt-i + \sum_i^n \beta i \ln REPt-i + \varepsilon t \quad (8)$$

Where ln MS stands for natural logarithmic values of money supply, ln CPI for natural logarithmic values of CPI, ln SP for natural logarithmic values of stock prices and ln REP for natural logarithmic values of real estate prices. Akaike Information Criterion is used for the optimal Lag length selection.

4.2. Johanssen's Cointegration Test

The Johansen test is precisely a multivariate generalization of the augmented Dickey-Fuller test. The generalization calls for examination of linear combinations of variables for unit roots. The Johansen test and estimation strategy (maximum likelihood) makes it possible to estimate all cointegrating vectors when there are more than two variables. If there are three variables each with unit roots, there are at most two cointegrating vectors. More generally, if there are n variables which all have unit roots, there are at most n−1 cointegrating vectors. The Johansen test provides estimates of all cointegrating vectors. Though Johannsen Test is used widely for multivariate cointegration testing, the author has used it to test the cointegration of only two variables.

The cointegration method characterizes the existence of a long-run relationship. According to Johansen (1988), a p-dimensional VAR of order k (VAR [k]) can be specified as follows:

$$Zt = d + \Pi 1 Zt-1 + \ldots. \Pi k Zt-k + \omega t (t = 1 \ldots T) \quad (9)$$

$$\Delta Zt = d + \Pi kZt - k + \sum_{i-1}^{k-1} (\theta \Delta Zt - i) + \omega t \quad (10)$$

Here Δ is the first difference operator, Π and θ are p-by-p matrices of unknown parameters and ω t is a Gaussian error term. The impact matrix Π could contain the long-run information about the relationship between money supply and CPI or money supply and stock index values or money supply and property index returns.

A full column rank of the matrix Π implies that all variables in the Zt are stationary. When the matrix has zero column rank, the expression is a first differenced VAR involving no long-run elements. If, however, the rank of Π is intermediate meaning that 0 < rank (Π) = r < p, there will be r cointegrating vectors that make the linear combinations of Zt become stationary or integrated.

This study performs two Johanssen cointegration tests. First, the maximum likelihood estimation procedure that provides a likelihood ratio test, called a Trace test, which evaluates the null hypothesis of, at most, r cointegrating vectors versus the general null of p cointegrating vectors. A second, likelihood ratio test is the maximum Eigenvalue test, which evaluates the null hypothesis of r cointegrating vectors against the alternative of (r + 1) cointegrating vectors (Johansen 1991).

5. ESTIMATION RESULTS

The results of ADF test show the order of integration. The following table gives the summarized results of ADF for all the time series in the select four countries (Tables 1-4).

The ADF results for all four countries in summary show that the data mostly becomes stationary after first differencing. Therefore, in order to conduct the Granger Causality Test the first differenced time-series for all variables has been generated.

5.1. Granger Causality Results

Pair-Wise Granger Causality Test requires an optimal lag length to establish the causality between the variables. The results obtained are very much sensitive to the lag length criterion used. We have used VAR lag order selection criteria (VAR) to arrive at the optimal lag length. In order to determine the significant lag values, VAR uses five different criteria viz.

1. LR: Sequential modified LR test statistic (each test at 5% level)
2. FPE: Final prediction error
3. AIC: Akaike information criterion
4. SC: Schwarz information criterion
5. HQ: Hannan-Quinn information criterion.

This test depends democratically on final prediction error, Akaike information criterion and Schwarz information criterion for the lag length selection.

The all countries summary of Bivariate Granger causality test provided in Table 5 gives an overall picture of causality between various variables in all the four countries. In Japan we see that money supply does not Granger cause CPI and property returns index. However significant causality can be seen running from money supply to Nikkei 225 and reverse from Nikkei 225 to the money supply. In the U.S.A a bivariate causality is seen running between money supply and CPI and money supply and Dow Jones industrial index. We do not see money supply in the U.S.A Granger causing S and P home price index, however interestingly reverse causation is significantly established. In India the results are little different, a bivariate Granger causality running between money supply and CPI is seen, with no significant causality between money supply and Sensex stock index. Money supply in India however is Granger causing property total returns with no feedback present. The Granger causality test results for China show that money supply does not Granger cause CPI, stock index returns or property returns. The reverse causality is also not present. China is the only country where no short term bivariate causality could be established between money supply and CPI, stock index and property index (Table 6).

Evident from the results given above, the long term cointegration between money supply and CPI is established by both trace test and Max-Eigen test in all the four countries. For Japan we can see that the null hypothesis is rejected in case of cointegration between money supply and CPI and money supply and property returns, however we do not have enough evidence to reject the null hypothesis of no cointegrating vector in case of Money Supply and Nikkei 225. Therefore significant long term association can be inferred between money supply and CPI, money supply and property index in Japan. In case of the United States of America the Null hypothesis of "no cointegrating vector" and of "at most one cointegrating vector" are rejected, indicating the presence of 2 cointegrating equations at 5% significance level. Therefore we can infer that there is a strong long-term relationship between money supply and CPI, Money Supply and DJIA and money supply and S and P home price index in the U.S.A. Rejection of the null hypothesis means that there is significant long-term association between the variables. For India, we can conclude that there are two cointegrating equations at 5% level signifying a strong long-term relationship between money supply and CPI in India. But we are not able to reject the Null hypotheses for the cointegration between "money supply and Sensex" and "money supply and property returns," therefore we conclude that there is no long-term association between the same. In case of China, there are two cointegrating equations with respect to "money supply and CPI" and "money supply and Shanghai Composite Stock Index," which indicates that these variables show strong long-term association. The cointegration between money supply and property returns show that there is one cointegrating equation at 5% level of significance. Money supply in China is cointegrated with CPI, stock index and property index returns.

6. CONCLUSION

This study has investigated empirically how the elastic nature of fiat money is mainly responsible for inflation and asset price fluctuations. Granger causality tests and Johansen's cointegration tests were used on four countries namely, Japan, the U.S.A, India and China, due to

Table 1: ADF test results - Japan

Exogenous	Level			First difference		
	Intercept	Intercept and trend	None	Intercept	Intercept and trend	None
Money supply						
t-statistics	1.936141	−2.32588	2.975386	−3.6244*	−4.3813*	−1.8237
Critical values at 5%	−2.86533	−3.41606	−1.94126	−2.86533	−3.41606	−1.9412
P	0.9999	0.4188	0.9994	0.0055	0.0025	0.0650
CPI						
t-statistics	−1.5861	−0.8143	1.0426	−3.2612*	−3.5350*	−2.2210*
Critical values at 5%	−2.8654	−3.4161	−1.9412	−2.8654	−3.4161	−1.9412
P	0.4892	0.9627	0.9225	0.0171	0.0365	0.0255
Nikkei (SI)						
t-statistics	−1.55683	−1.84416	−0.44178	−20.299*	−20.287*	−20.295*
Critical values at 5%	−2.8652	−3.4159	−1.9412	−2.8652	−3.4159	−1.9412
P	0.5042	0.6822	0.5232	0.0000	0.0000	0.0000
Property index TOT						
t-statistics	−1.83155	−2.10421	0.002385	−17.274*	−17.252*	−17.2583*
Critical values at 5%	−2.8687	−3.4214	−1.9416	−2.8687	−3.4214	−1.9416
P	0.3649	0.5413	0.6828	0.0000	0.0000	0.0000

The significance level is outrightly mentioned at 5% and the P values are given for both Augmented Dickey Fuller Test and Granger Causality. For Johhansen's Cointegration the significance value cant be gotten from Eviews, however the test statistics are easily indicated to be significant at 5% level

Table 2: ADF test results - USA

Exogenous	Level			First difference		
	Intercept	Intercept and trend	None	Intercept	Intercept and trend	None
Money supply						
t-statistics	8.937182	5.213527	10.04840	−1.4613	−7.9331*	−0.4191
Critical values at 5%	−2.86558	−3.41644	−1.94129	−2.86568	−3.41645	−1.9413
P	1.0000	1.0000	1.0000	0.5528	0.0000	0.5321
CPI						
t-statistics	2.61980	−4.07949	8.912788	−14.662*	−15.098*	−2.1097*
Critical values at 5%	−2.86556	−3.41643	−1.94128	−2.8655	−3.4164	−1.9412
P	1.0000	0.0070	1.0000	0.0000	0.0000	0.0336
DJII (SI)						
t-statistics	1.27601	−1.203953	2.562123	−26.093*	−26.235*	−25.9006*
Critical values at 5%	−2.86555	−3.416410	−1.94128	−2.86556	−3.41642	−1.941288
P	0.9986	0.9082	0.9977	0.0000	0.0000	0.0000
S and P home price index						
t-statistics	−1.44195	−2.962981	0.207156	−3.0197*	−3.0271	−2.8866*
Critical values at 5%	−2.86970	−3.422903	−1.94174	−2.8697	−3.4229	1.941745
P	0.5619	0.1443	0.7459	0.0341	0.1263	0.0039

The significance level is outrightly mentioned at 5% and the P values are given for both Augmented Dickey Fuller Test and Granger Causality. For Johhansen's Cointegration the significance value cant be gotten from Eviews, however the test statistics are easily indicated to be significant at 5% level

Table 3: ADF test results - India

Exogenous	Level			First difference		
	Intercept	Intercept and trend	None	Intercept	Intercept and trend	None
Money supply						
t-statistics	1.755837	−3.83931	4.266890	−3.3472*	−4.3996*	−0.6153*
Critical values at 5%	−2.86566	−3.41659	−1.94130	−2.865643	−3.416590	−1.941298
P	0.9997	0.0151	1.0000	0.0133	0.0023	0.4507
CPI						
t-statistics	−0.065465	−3.967964	2.854666	−4.5585*	−4.5495*	−2.5196*
Critical values at 5%	−2.865536	−3.416382	−1.941285	−2.865536	−3.416382	−1.941285
P	0.9510	0.0101	0.9991	0.0002	0.0013	0.0115
SENSEX (SI)						
t-statistics	−1.358891	−2.015876	2.833932	−19.2668*	−19.2817*	−18.8896*
Critical values at 5%	−2.867859	−3.420022	−1.941542	−2.867874	−3.420045	−1.941543
P	0.6030	0.5906	0.9990	0.0000	0.0000	0.0000
Property index TOT						
t-statistics	−1.787658	−2.275410	0.748856	−9.3823*	−9.3227*	−9.3544*
Critical values at 5%	−2.897223	−3.465548	−1.944811	−2.8976	−3.4662	−1.9448
P	0.3841	0.4421	0.8741	0.0000	0.0000	0.0000

The significance level is outrightly mentioned at 5% and the P values are given for both Augmented Dickey Fuller Test and Granger Causality. For Johhansen's Cointegration the significance value cant be gotten from Eviews, however the test statistics are easily indicated to be significant at 5% level

Table 4: ADF test results - China

Exogenous	Level			First difference		
	Intercept	Intercept and trend	None	Intercept	Intercept and trend	None
Money supply						
t-statistics	2.376635	−0.073039	2.281838	−0.92193	−3.739973	0.504057
Critical values at 5%	−2.876595	−3.433651	−1.94250	−2.87659	−3.433651	−1.94250
P	1.0000	0.9950	0.9948	0.7796	0.0220	0.8235
CPI						
t-statistics	−2.649670	−2.848468	−1.330267	−5.830830	−5.860826	−5.837643
Critical values at 5%	−2.877186	−3.434569	−1.942574	−2.877186	−3.434569	−1.942574
P	0.0850	0.1821	0.1694	0.0000	0.0000	0.0000
S SECI (SI)						
t-statistics	−2.71044	−2.985782	−0.305484	−7.70088	−7.68563	−7.71232
Critical values at 5%	−2.87560	−3.432115	−1.942383	−2.87560	−3.43211	−1.94239
P	0.0740	0.1388	0.5747	0.0000	0.0000	0.0000
Property index TOT						
t-statistics	−2.51264	−2.279695	−1.55852	−12.1551	−12.1983	−12.1197
Critical values at 5%	−2.88505	−3.446765	−1.94344	−2.88524	−3.44707	−1.94347
P	0.1149	0.4414	0.1116	0.0000	0.0000	0.0000

H_0: The variable has a unit root. *Denotes the rejection of the unit root null hypothesis for the 5% significance. The choice of optimum lag for the ADF test was decided on the basis of minimizing the Schwarz information criterion

Table 5: All countries summary of Granger causality tests

Null hypothesis	Observe	F-statistics	P	Reject/do not reject
Japan				
Money supply does not Granger cause CPI	712	0.46905	0.8956	Do not reject
CPI does not Granger cause money supply	712	1.01924	0.4227	Do not reject
Money supply does not Granger cause NIKKEI 225	717	3.09132	0.0007	Reject
NIKKEI 225 does not Granger cause money supply	717	3.65836	9.E-05	Reject
Money supply does not Granger cause property index	231	0.53324	0.5874	Do not reject
Property index does not granger cause money supply	231	0.54084	0.5830	Do not reject
The U.S.A				
Money supply does not Granger cause CPI	673	2.06533	0.0252	Reject
CPI does not Granger cause money supply	673	7.14182	1.E-10	Reject
Money supply does not Granger cause DJII	673	4.22307	1.E-05	Reject
DJII does not Granger cause money supply	673	5.31898	1.E-07	Reject
Money supply does not Granger cause S and P home	336	1.42191	0.1692	Do not reject
S and P home does not Granger cause money supply	336	2.10498	0.0238	Reject
India				
Money supply does not Granger cause CPI	672	6.75567	5.E-10	Reject
CPI does not Granger cause money supply	672	6.32566	3.E-09	Reject
Money supply does not Granger cause Sensex	410	1.01739	0.4069	Do not reject
Sensex does not Granger cause money supply	410	0.85368	0.5124	Do not reject
Money supply does not Granger cause property values	49	3.94843	0.0265	Reject
Property values does not Granger cause money supply	49	1.15322	0.3250	Do not reject
China				
Money supply does not Granger cause CPI	185	0.21831	0.9943	Do not reject
CPI does not Granger cause money supply	185	0.85732	0.5745	Do not reject
Money supply does not Granger cause shanghai comp	192	0.85383	0.5777	Do not reject
Shanghai comp does not Granger cause money supply	192	1.82105	0.0602	Do not reject
Money supply does not Granger cause property returns index	106	1.07676	0.3881	Do not reject
Property returns index does not Granger cause money supply	106	0.37080	0.9461	Do not reject

their leading money supply figures. This multi-country analysis of the influence of elastic money supply on CPI and asset price yields varied yet interesting results. The Johansen's Cointegration test results in Japan show that there is significant long-term relationship between money supply - CPI and money supply - property returns.

Index, however no Granger causality is seen running between these variables. Interestingly money supply and Nikkei stock index are not cointegrated significantly, yet show significant bivariate Granger causality. In the U.S.A money supply is strongly cointegrated with CPI, stock index and property index values, showing a strong long term association between these variables. Money supply in the U.S.A seems to be influencing heavily the inflation rates and asset prices. The Granger causality results also validate a causality running from money supply to CPI and to Dow Jones Industrial Index with the feedback. Money supply in the U.S.A is not Granger causing the S and P home price index returns; however the reverse causality is significantly established.

The empirical analysis in case of India shows strong cointegration between money supply and CPI, but does not validate the same between money supply and Sensex and money supply and property

Table 6: Johansen's cointegration test results

H_0	H_1	Eigenvalue	Trace statistics	5% critical value	Max-Eigen statistics	5% critical value	VAR
Japan							
MS-CPI							
r=0	r=1	0.020763	17.75772**	15.49471	14.93923**	14.26460	2
r≤2	r=2	0.003951	2.818492	3.841466	2.818492	3.841466	2
MS-Nikkei 225							
r=0	r=1	0.014822	12.64133	15.49471	10.70691	14.26460	2
r≤2	r=2	0.002694	1.934415	3.841466	1.934415	3.841466	2
MS-property returns							
r=0	r=1	0.055627	21.80974**	15.49471	21.57744**	14.26460	2
r≤2	r=2	0.000616	0.232302	3.841466	0.232302	3.841466	2
U.S.A							
MS-CPI							
r=0	r=1	0.047138	38.07332**	15.49471	32.49589**	14.26460	2
r≤2	r=2	0.008253	5.577422**	3.841466	5.577422**	3.841466	2
MS-DJII							
r=0	r=1	0.032385	28.89446**	15.49471	22.15591**	14.26460	2
r≤2	r=2	0.009963	6.738545**	3.841466	6.738545**	3.841466	2
MS-S and P home price index							
r=0	r=1	0.055613	25.79843**	15.49471	19.22559**	14.26460	2
r≤2	r=2	0.019372	6.572846**	3.841466	6.572846**	3.841466	2
India							
MS-CPI							
r=0	r=1	0.027403	24.67689**	15.49471	18.67208**	14.26460	2
r≤2	r=2	0.008896	6.004812**	3.841466	6.004812**	3.841466	2
MS - Sensex							
r=0	r=1	0.024315	10.72664	15.49471	10.09240	14.26460	2
r≤2	r=2	0.001546	0.634237	3.841466	0.634237	3.841466	2
MS - property tot returns index							
r=0	r=1	0.185984	12.20993	15.49471	10.08301	14.26460	2
r≤2	r=2	0.042478	2.126922	3.841466	2.126922	3.841466	2
China							
MS-CPI							
r=0	r=1	0.149270	34.38442**	15.49471	29.90710**	14.26460	2
r≤2	r=2	0.023911	4.477324**	3.841466	4.477324**	3.841466	2
MS - Shanghai composite index							
r=0	r=1	0.120250	33.19868**	15.49471	24.59849**	14.26460	2
r≤2	r=2	0.043804	8.600195**	3.841466	8.600195**	3.841466	2
MS - property tot returns index							
r=0	r=1	0.209286	28.26455**	15.49471	24.89082**	14.26460	2
r≤2	r=2	0.031327	3.373738	3.841466	3.373738	3.841466	2

VAR is order of the variance. **denotes statistically significant at the 5% level. H0 and H1 denote the null and alternative hypothesis respectively and r denotes the number of cointegrating vectors

returns. The money supply in India is Granger causing the CPI with the feedback. No causality is seen between money supply and Sensex; however significant causality is inferred from money supply to property returns without the feedback. Money supply in India seems to be significantly causing the inflation rates and property returns, but not the stock index returns. for China cointegration tests show that money supply is strongly cointegrated with all the three variables. Therefore long term strong relationship can be assumed between money supply and CPI and money supply and asset prices in China. The Granger causality results in China show no causality what so ever running from money supply to CPI and asset prices. Over all, in all the four countries money supply seems to have significant long term influence on price levels and asset prices.

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