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NEED/IMPORTANCE OF THE STUDY
STATEMENT OF THE PROBLEM
OBJECTIVES
HYPOTHESIS (ES)
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RESULTS & DISCUSSION
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RECOMMENDATIONS/SUGGESTIONS
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APPENDIX/ANNEXURE

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A STUDY OF MONETARY POLICY IMPACT ON PMI (PRODUCTION MANAGER INDEX)

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ABSTRACT

In any economy, maintaining the liquidity by the central bank to keep the momentum in the economy intact will be a big challenge. In the modern economy, industrial growth is playing the key role for the growth of the economy. The present scenario has been emphasized how monetary policy is having a influence on PMI of India. The Granger casualty test has been applied on Johansen co integrated data and result reveals that CRR, Repo rate, reverse repo rate and SLR Granger causing the PMI. The linear regression model indicated that the PMI influence the GDP but it has failed to influence the IIP. The VAR model predicted the IIP future Momentum downwards but gold is expected to go upside based on the PMI. This study is useful to the industries production manager's investors of the equity, bankers and regulators.

KEYWORDS

PMI, SLR, CRR, investors, economy, liquidity, growth.

INTRODUCTION

The pace of growth in India's manufacturing sector improved to a four-month high in January, climbing into expansion territory after the contraction seen at the end of last year. The seasonally Manufacturing production Managers' Index (PMI) posted a reading of 51.1 in January, compared with 49.1 in December, data released on Monday showed. A reading above 50 denotes expansion.

Data showed that levels of production and total new business registered mild increases following contractions in the prior survey month. The consumer goods sub-sector remained the principal growth engine at the start of the year, seeing substantial expansions of both output and new orders. In contrast, producers of investment goods saw a fall in output and new orders, while production volumes stagnated in the intermediate goods category.

Moreover, the levels of incoming new export business has now risen in each of the past 28 months. Although there was some job creation in January, the survey noted that this increase was insufficient to reduce the pressure on manufacturers' capacity.

"The opening month of 2016 saw a rebound in new business - from both domestic and external clients - leading manufacturers in India to scale up output following a short-lived downturn recorded in December," said Pollyanna De Lima, economist at Market, the agency that compiles the index. "Whereas the trends in the growth rates are relatively weak in comparison with the long-run series averages, January's PMI data paints a brighter picture of the Indian economy." In its outlook, the survey indicated an unchanged repo rate at 6.75% by the Reserve Bank of India in its policy review on Tuesday, even though the central bank is likely to continue its monetary policy loosening cycle in 2016.

OBJECTIVES OF THE STUDY

1. To study the long-run relationship of monetary policy Key rates with PMI.
2. To know the monetary policy key rates influence on PMI.
3. To study the PMI impact on IIP and GDP.
4. To predict the future moment of IIP and gold price based on PMI.

REVIEW OF LITERATURE

Robert Killins (2016)

This paper investigates the reaction of equity and volatility indices in the U.S. and Canada to changes in monetary policy by each respective country. The results confirm previous literature that suggests contractionary changes in monetary policy in the U.S. results in downward pressure on U.S. equity indices. Additionally, this research finds that monetary policy changes do not have any significant impact on the volatility index in the U.S. (VIX). The results from the Canadian data show a much different picture. Contractionary changes of monetary policy in both Canada and the U.S. seem to drive Canadian equity markets in an upward manner. These monetary policy shocks also have a significant impact on volatility indices in Canada. This research documents the dynamic relationship monetary policy has on equity markets in the U.S. and Canada.

Reinder Haitsma, Deren Unalmis & Jakob de Haan (2016)

Using an event study method, we examine how stock markets respond to the policies of the European Central Bank during 1999-2015. We use market prices of futures (government bonds) to identify surprises in (un)conventional monetary policy. Our results suggest that especially unconventional monetary policy surprises affect the EURO STOXX 50 index. We also find evidence for the credit channel, notably for unconventional monetary policy surprises. Our results also suggest that value and past loser stocks show a larger reaction to monetary policy surprises. These results are confirmed if identification of monetary policy surprises is based on the Rigobon-Sack heteroscedasticity approach.

Owolabi A. Usman, Ph. D. (2014)

The study empirically examines the impact of monetary policy on industrial growth in Nigerian economy, in line with the objectives of this study, secondary data were obtained from central bank of Nigeria statistical bulletin covering the period of 1970 to 2010. In concluding the analysis, multiple regressions were employed to analyze data on such variables, manufacturing output, Treasury Bills, Deposit & leading and Rediscount Rate for Nigeria over the period 1970 to 2010 were all found have significant effects on the industrial Growth with the Adjusted R2 of 0.8156 (81.56%) Following the outcome of this study, it is therefore concluded that Rediscount Rate, and Deposit have significant positive effect on industrial output but Treasury Bills has the negative impact on industrial output. All the variables are statistically significant. It is order to improve economic growth; it is recommended that government should develop the industrial sectors of the economy through its capital expenditure. With this, capital expenditure on productive activities and social overheads capital will contribute positively to industrial growth which will invariably enhance economic growth.

Yong Ma & Xingkai Lin (2016)

This paper investigates the relationship between financial development and the effectiveness of monetary policy using panel data from 41 economies. The results show that the effects of monetary policy on output and inflation are significantly and negatively correlated with financial development, indicating that the effectiveness of monetary policy declines as the financial system becomes more developed. This finding is robust across all the different specifications and estimation methods examined. Our paper provides new evidence and insights to the long-standing debate on the relationship between financial development and the effectiveness of monetary policy.

Jean Boivin, Marc Giannoni & Ilian Mihov (2007)

This paper disentangles fluctuations in disaggregated prices due to macroeconomic and sectoral conditions using a factor-augmented vector auto regression estimated on a large data set. On the basis of this estimation, we establish eight facts: (1) Macroeconomic shocks explain only about 15% of sectoral inflation fluctuations;(2) The persistence of sectoral inflation is driven by macroeconomic factors; (3) While disaggregated prices respond quickly to sector-specific shocks, their responses to aggregate shocks are small on impact and larger thereafter; (4) Most prices respond with a significant delay to identified monetary policy shocks, and show little evidence of a "price puzzle," contrary to existing studies based on traditional VARs; (5) Categories in which consumer prices fall the most following a monetary policy shock tend to be those in which quantities consumed fall the least; (6) The observed dispersion in the reaction of producer prices is relatively well explained by the degree of market power; (7) Prices in sectors with volatile idiosyncratic shocks react rapidly to aggregate monetary policy shocks; (8) The sector-specific components of prices and quantities move in opposite directions.

Imoughele lawrence ehikioya (2014)

Monetary policy is one of the macroeconomic instruments with which monetary authority in a country employed in the management of their economy to attained fundamental objectives of price stability, maintenance of balance of payments equilibrium, and promotion of employment, output growth and sustainable development. These objectives are necessary for the attainment of internal and external balance of value of money and promotion of long run growth of the real economic sectors such as the manufacturing sector. It is against this background, that this study examines the impact of monetary policy on Nigeria's manufacturing sector performance for the period 1986- 2012. Data were collected from the Statistical Bulletin and Annual Report and Statement of Accounts of the Central Bank of Nigeria as well as the Annual Abstracts of statistics (various issues) published by the National Bureau of Statistics (NBS). Unit root test, Granger Causality test, co integration and VAR model were some of the econometrics techniques used for data estimation. Augmented Dickey Fuller (ADF) test statistic revealed that the time series properties of the variables attained stationarity at level and first order. The variables were co integrated at most 2 with at least 3 co integrating equations. The individual variables: external reserve, exchange rate and inflation rate were statistically significant to manufacturing sector output while broad money supply and interest rate were not statistically significant to manufacturing sector output in the previous and current year. However, interest rate, exchange rate and external reserve impacted negatively on the sector output but broad money supply and inflation rate affect the sector positively. The pair-wise Granger Causality results suggest that real exchange rate and external reserves granger cause Nigeria's manufacturing output to each other unidirectional. The paper also found that the manufacturing sector contribute insignificantly to the Nigerian economy. Therefore, the study recommended among others that monetary authority should create and implement monetary policies that favored efficient provider of favorable investment climate by facilitating the emergency of market based interest rate and exchange rate regimes that attract both domestic and foreign investment to the manufacturing industrial sector that are currently operating far below installed capacity. However, in order to maintain and exploit the current investment climate, the Central Bank of Nigeria should introduce more monetary instruments that are flexible enough to meet the supply and demands needs of the manufacturing sector.

Anamika Singh (2014)

The study of monetary policy impact on market volatility has been done by considering 15 years data. Monetary policy is the fixed event where market will wait to take fix direction based on the policy rates changes. CRR and SLR are the two key liquid rates playing vital role in controlling of liquidity in India. This analysis had proven that IIP influenced by changes of CRR. Interest rates found to be non-significant when it comes to be NIFTY volatility. Augmented Dickey Fuller Test (ADF) has been applied for the stationary of the data which were averaged yearly. Arch model had proven that NIFTY volatility is getting influenced whenever monetary policy announced. This analysis is useful for the traders, investors, pension funds, mutual funds, portfolio managers and investment bankers.

Himani (2014)

In every country government takes some actions in Economic field that cover the systems for setting Interest Rates & Government Budget as well as labor market, National ownership & many other areas of government interventions into the Economy. Such policies are often influenced by International Institutions like IMF or World Bank as well as political beliefs & consequent policies of parties. There are many types of Economic policy. A few examples of the kind of economic policies that exist include: Macro Economic Stabilization Policy, Individual Policy, Fiscal Policy and Monetary Policy.

Irfan Hameed and Amen Ume (2011)

This research article focuses on the impact of Monetary Policy on GDP. GDP no doubt is affected by the Monetary Policy of the state. The research papers of various authors have been studied in this regard to prove the Hypothesis and after in depth analysis by applying Regression Analysis technique it has been observed that the relationship between the two exists. The data of past 30 years of Pakistan has been used for driving the conclusion. The study proved that the interest rate has minor relationship with GDP but the Growth in Money Supply greatly affects the GDP of an economy, obviously various unknown factors also affects the GDP. Growth in Money Supply has a huge impact on GDP. The Research study can further be used for developmental projects for the Growth of Economy, Quality improvements, Household production, the underground economy, Health and life expectancy, the environment, Political immunity and ethnic justice.

Georgios Chortareas & Christos Mavrodimitrakis (2016)

We consider the ability of monetary policy to fully stabilize pure demand shocks in a monetary union with strategically acting fiscal authorities. We show that when one national fiscal authority enjoys a strategic advantage over the other and fiscal policy can directly affect inflation, monetary policy cannot fully stabilize pure demand shocks at the union level, unless they are common. Moreover, we characterize a situation where country specific fiscal policies diverge, being counter-cyclical for one country and pro-cyclical for the other, for high enough values of the direct effect of fiscal policy on the inflation parameter. The coordination of national fiscal policies becomes desirable for the union central bank.

Ben S. Bernanke & Jean Boivin (2003)

Structural vector auto regressions (VARs) are widely used to trace out the effect of monetary policy innovations on the economy. However, the sparse information sets typically used in these empirical models lead to at least two potential problems with the results. First, to the extent that central banks and the private sector have information not reflected in the VAR, the measurement of policy innovations is likely to be contaminated. A second problem is that impulse responses can be observed only for the included variables, which generally constitute only a small subset of the variables that the researcher and policymaker care about. In this paper, we investigate one potential solution to this limited information problem, which combines the standard structural VAR analysis with recent developments in factor analysis for large data sets. We find that the information that our factor-augmented VAR (FAVAR) methodology exploits is indeed important to properly identify the monetary transmission mechanism. Overall, our results provide a comprehensive and coherent picture of the effect of monetary policy on the economy.

NEED OF THE STUDY

Monetary policy aim is to manage the liquidity in order to fuel the growth of the country by controlling the key economic factors. Production manager index is the future production estimation index through which country growth momentum can be identified. Central bank decisions will have impact on IIP which gives the monthly production activity. Many research papers focused on IIP but no research has been found in future production activity influenced by the central bank monetary policy.

SCOPE OF THE STUDY

The present analyses has considered the data from the year 2012 to 2016.

In this study all the variables where converted into stationary and the same are as per following:

- Repo rates
- Reverse Repo rates
- Inflation
- Gold price
- SLR (Statutory Liquidity Ratio)
- PLR (Prime Lending Rate)
- PMI (Production Manager Index)
- CRR (Cash Reserve Ratio)

- IIP (Index Of Industrial Production)
- GDP (Gross Domestic Product)

RESEARCH METHODOLOGY

TOOLS FOR ANALYSIS

AUTO REGRESSIVE DISTRIBUTED LAG (ADRL) METHOD

In statistics and econometrics, a distributed lag model is a model for time series data in which a regression equation is used to predict current values of a dependent variable based on both the current values of an explanatory and the lagged (past period) values of this explanatory variable.

$y_t = a + w_o x_t + w_1 x_{t-1} + w_2 x_{t-2} + \ldots +$ error term

or the form

$y_t = a + w_o x_t + w_1 x_{t-1} + w_2 x_{t-2} + \ldots + w_n x_{t-n}$ +error term,

where y_t is the value at time period t of the dependent variable y, a is the intercept term to be estimated, and w_i is called the lag weight (also to be estimated) placed on the value i periods previously of the explanatory variable x. In the first equation, the dependent variable is assumed to be affected by values of the independent variable arbitrarily far in the past, so the number of lag weights is infinite and the model is called an *infinite distributed lag model*. In the alternative, second, equation, there are only a finite number of lag weights, indicating an assumption that there is a maximum lag beyond which values of the independent variable do not affect the dependent variable; a model based on this assumption is called a *finite distributed lag model*.

In an infinite distributed lag model, an infinite number of lag weights need to be estimated; clearly this can be done only if some structure is assumed for the relation between the various lag weights, with the entire infinitude of them expressible in terms of a finite number of assumed underlying parameters. In a finite distributed lag model, the parameters could be directly estimated by ordinary least squares (assuming the number of data points sufficiently exceeds the number of lag weights); nevertheless, such estimation may give very imprecise results due to extreme multicollinearity among the various lagged values of the independent variable, so again it may be necessary to assume some structure for the relation between the various lag weights.

JOHANSEN TEST

In statistics, the Johansen test, named after Soren Johansen, is a procedure for testing co-integration of several, I(1)time series. This test permits more than one co-integrating relationship so is more generally applicable than the Engle–Granger test which is based on the Dickey–Fuller (or the augmented) test for unit roots in the residuals from a single (estimated) co-integrating relationship

There are two types of Johansen test, either with trace or with eigenvalue, and the inferences might be a little bit different. The null hypothesis for the trace test is that the number of cointegration vectors is $r=r^*<k$, vs. the alternative that $r=k$. Testing proceeds sequentially for $r^*=1,2$, etc. and the first non-rejection of the null is taken as an estimate of r. The null hypothesis for the "maximum eigenvalue" test is as for the trace test but the alternative is $r=r^*+1$ and, again, testing proceeds sequentially for $r^*=1,2$, etc., with the first non-rejection used as an estimator for r.

Just like a unit root test, there can be a constant term, a trend term, both, or neither in the model. For a general VAR(p) model:

$$X_t = \mu + \Phi D_t + \Pi_p X_{t-p} + \cdots + \Pi_1 X_{t-1} + e_t, \quad t = 1, \ldots, T$$

There are two possible specifications for error correction: that is, two VECM (vector error correction models):

1. The longrun VECM:

$$\Delta X_t = \mu + \Phi D_t + \Pi X_{t-p} + \Gamma_{p-1} \Delta X_{t-p+1} + \cdots + \Gamma_1 \Delta X_{t-1} + \varepsilon_t, \quad t = 1, \ldots, T$$

Where

$$\Gamma_i = \Pi_1 + \cdots + \Pi_i - I, \quad i = 1, \ldots, p-1.$$

2. The transitory VECM:

$$\Delta X_t = \mu + \Phi D_t - \Gamma_{p-1} \Delta X_{t-p+1} - \cdots - \Gamma_1 \Delta X_{t-1} + \Pi X_{t-1} + \varepsilon_t, \quad t = 1, \cdots, T$$

Where

$$\Gamma_i = \left(\Pi_{i+1} + \cdots + \Pi_p\right), \quad i = 1, \ldots, p-1.$$

Be aware that the two are the same. In both VECM (Vector Error Correction Model),

$$\Pi = \Pi_1 + \cdots + \Pi_p - I.$$

Inferences are drawn on Π, and they will be the same, so is the explanatory power.

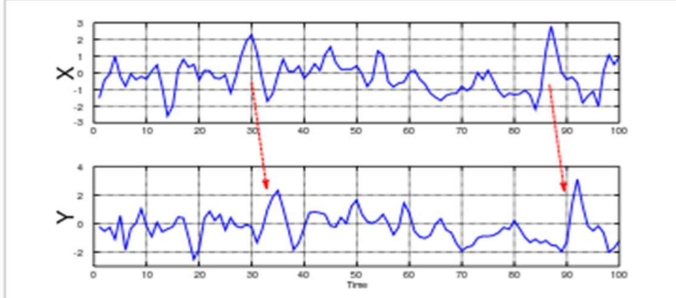
GRANGER CAUSALITY

The Granger causality test is a statistical hypothesis test for determining whether one time series is useful in forecasting another, first proposed in 1969. Ordinarily, regressions reflect "mere" correlations, but Clive Granger argued that causality in economics could be tested for by measuring the ability to predict the future values of a time series using prior values of another time series. Since the question of "true causality" is deeply philosophical, and because of the post hoc ergo propter hoc fallacy of assuming that one thing preceding another can be used as a proof of causation, econometricians assert that the Granger test finds only "predictive causality".

A time series *X* is said to Granger-cause *Y* if it can be shown, usually through a series of t-tests and F-tests on lagged values of *X* (and with lagged values of *Y* also included), that those *X* values provide statistically significant information about future values of *Y*.

Granger also stressed that some studies using "Granger causality" testing in areas outside economics reached "ridiculous" conclusions. "Of course, many ridiculous papers appeared", he said in his Nobel lecture. However, it remains a popular method for causality analysis in time series due to its computational simplicity. The original definition of Granger causality does not account for latent confounding effects and does not capture instantaneous and non-linear causal relationships, though several extensions have been proposed to address these issues.

FIG. 1



When time series X Granger-causes time series Y, the patterns in X are approximately repeated in Y after some time lag (two examples are indicated with arrows). Thus, past values of X can be used for the prediction of future values of Y.

Granger defined the causality relationship based on two principles:

1. The cause happens prior to its effect.
2. The cause has *unique* information about the future values of its effect.

Given these two assumptions about causality, Granger proposed to test the following hypothesis for identification of a causal effect of X on Y :

$$\mathbb{P}[Y(t+1) \in A \mid \mathcal{I}(t)] \neq \mathbb{P}[Y(t+1) \in A \mid \mathcal{I}_{-X}(t)],$$

where P refers to probability, A is an arbitrary non-empty set, and $\mathcal{I}(t)$ and $\mathcal{I}_{-X}(t)$ respectively denote the information available as of time t in the entire universe, and that in the modified universe in which X is excluded. If the above hypothesis is accepted, we say that X Granger-causes Y.

TWO WAY ANNOVA

In statistics, the two-way analysis of variance (ANOVA) is an extension of the one-way ANOVA that examines the influence of two different categorical independent variables on one continuous dependent variable. The two-way ANOVA not only aims at assessing the main effect of each independent variable but also if there is any interaction between them.

DATA SET

Let us imagine a data set for which a dependent variable may be influenced by two **factors** which are potential sources of variation. The first factor has I levels ($i \in \{1, \ldots, I\}$) and the second has J levels ($j \in \{1, \ldots, J\}$). Each combination (i, j) defines a **treatment**, for a total of $I \times J$ treatments. We represent the number of **replicates** for treatment (i, j) by n_{ij}, and let k be the index of the replicate in this treatment ($k \in \{1, \ldots, n_{ij}\}$).

From these data, we can build a contingency table, where $n_{i+} = \sum_{j=1}^{J} n_{ij}$ and $n_{+j} = \sum_{i=1}^{I} n_{ij}$, and the total number of replicates is equal to $n = \sum_{i,j} n_{ij} = \sum_{i} n_{i+} = \sum_{j} n_{+j}$.

The experimental design is **balanced** if each treatment has the same number of replicates, K. In such a case, the design is also said to be **orthogonal**, allowing to fully distinguish the effects of both factors. We hence can write $\forall i, j \; n_{ij} = K$, and $\forall i, j \; n_{ij} = \frac{n_{i+} \cdot n_{+j}}{n}$.

MODEL

Upon observing variation among all n data points, for instance via a histogram, "probability may be used to describe such variation".[4] Let us hence denote by Y_{ijk} the random variable which observed value y_{ijk} is the k-th measure for treatment (i, j). The **two-way ANOVA** models all these variables as varying independently and normally around a mean, μ_{ij}, with a constant variance, σ^2 (homoscedasticity):

$$Y_{ijk} \mid \mu_{ij}, \sigma^2 \overset{i.i.d.}{\sim} \mathcal{N}(\mu_{ij}, \sigma^2).$$

Specifically, the mean of the response variable is modeled as a linear combination of the explanatory variables:

$$\mu_{ij} = \mu + \alpha_i + \beta_j + \gamma_{ij},$$

where μ is the grand mean, α_i is the additive main effect of level i from the first factor (i-th row in the contigency table), β_j is the additive main effect of level j from the second factor (j-th column in the contigency table) and γ_{ij} is the non-additive interaction effect of treatment (i, j) from both factors (cell at row i and column j in the contigency table).

An other, equivalent way of describing the two-way ANOVA is by mentioning that, besides the variation explained by the factors, there remains some statistical noise. This amount of unexplained variation is handled via the introduction of one random variable per data point, ϵ_{ijk}, called error. These n random variables are seen as deviations from the means, and are assumed to be independent and normally distributed:

$$Y_{ijk} = \mu_{ij} + \epsilon_{ijk} \text{ with } \epsilon_{ijk} \overset{i.i.d.}{\sim} \mathcal{N}(0, \sigma^2).$$

VAR MODEL

Vector autoregression (VAR) is an econometric model used to capture the linear interdependencies among multiple time series. VAR models generalize the uni-variate autoregressive model (AR model) by allowing for more than one evolving variable. All variables in a VAR enter the model in the same way: each variable has an equation explaining its evolution based on its own lags and the lags of the other model variables. VAR modeling does not require as much knowledge about the forces influencing a variable as do structural models with simultaneous equations: The only prior knowledge required is a list of variables which can be hypothesized to affect each other intertemporally.

A VAR model describes the evolution of a set of k variables (called *endogenous variables*) over the same sample period (t = 1,...,T) as a linear function of only their past values. The variables are collected in a $k \times 1$ vectory_t, which has as the i^{th} element, $y_{i,t}$, the observation at time "t" of the i^{th} variable. For example, if the i^{th} variable is GDP, then $y_{i,t}$ is the value of GDP at time t.

A *p-th order VAR*, denoted VAR(p)

Formula

$$y_t = c + A_1 y_{t-1} + A_2 y_{t-2} + \cdots + A_p y_{t-p} + e_t,$$

CALCULATIONS

Collected Data

TABLE 1

Month	Year	PMI	PLR	Inflation	Repo rates	Reverse repo rates	CRR	SLR	GOLD	GDP	IIP
Apr	2012	54.9	10.75	10.21	8	7	4.75	24	17390293	1.267973	188.65
May	2012	54.8	10.5	10.16	8	7	4.75	24	29372177	1.267973	194.55
Jun	2012	55	10.5	10.05	8	7	4.75	24	29861659	1.267973	193.7167
Jul	2012	52.9	10.5	9.84	8	7	4.75	24	27455529	1.799113	192.5833
Aug	2012	52.8	10.5	10.31	8	7	4.75	23	22566645	1.799113	188.35
Sep	2012	52.8	10.5	9.14	8	7	4.5	23	29445024	1.799113	190.7167
Oct	2012	52.9	10.5	9.60	8	7	4.5	23	22518401	1.329112	200.65
Nov	2012	53.6	10.5	9.55	8	7	4.25	23	27475189	1.329112	191.25
Dec	2012	54.8	10.5	11.17	8	7	4.25	23	24214794	1.329112	202.7
Jan	2013	53.3	10.5	11.62	7.75	6.75	4.25	23	27770797	1.56012	205.6167
Feb	2013	54.3	10.5	12.06	7.75	6.75	4	23	24919063	1.56012	205.9667
Mar	2013	52	10.25	11.44	7.5	6.5	4	23	23043838	1.56012	226.2167
Apr	2013	51	10.25	10.24	7.5	6.5	4	23	31588018	1.653434	187.75
May	2013	50.1	10.25	10.68	7.25	6.25	4	23	31858179	1.653434	182.7
Jun	2013	50.2	10.25	11.06	7.25	6.25	4	23	29393079	1.653434	186.7833
Jul	2013	50.1	10.25	10.85	7.25	6.25	4	23	19768105	1.645063	196.3833
Aug	2013	48.5	10.25	10.75	7.25	6.25	4	23	18419356	1.645063	185.7167
Sep	2013	49.6	9.5	10.70	7.5	6.5	4	23	15445776	1.645063	188.1
Oct	2013	49.7	8.75	11.06	7.625	6.625	4	23	12834054	1.844664	194.3
Nov	2013	51.3	8.75	11.47	7.75	6.75	4	23	10721733	1.844664	179.7
Dec	2013	50.8	10.25	9.13	7.75	6.75	4	23	10623616	1.844664	195.5167
Jan	2014	51.3	10.25	7.24	8	7	4	23	11266943	1.532241	203.0333
Feb	2014	52.6	10.25	6.73	8	7	4	23	8958410	1.532241	192.6167
Mar	2014	51.3	10.25	6.70	8	7	4	23	10864836	1.532241	215.7667
Apr	2014	51.2	10.25	7.08	8	7	4	23	7691112	1.938651	189.4667
May	2014	51.4	10.25	7.02	8	7	4	23	8735641	1.938651	191.1667
Jun	2014	51.5	10.25	6.49	8	7	4	22.5	8020296	1.938651	185.5333
Jul	2014	53	10.25	7.23	8	7	4	22.5	10356115	1.917222	187.55
Aug	2014	52.4	10.25	6.75	8	7	4	22	7717367	1.917222	175.7833
Sep	2014	51	10.25	6.30	8	7	4	22	10140085	1.917222	188.7333
Oct	2014	51.6	10.25	4.98	8	7	4	22	7506124	1.542313	170.9
Nov	2014	53.3	10.25	4.12	8	7	4	22	10053571	1.542313	181.5
Dec	2014	54.5	10.25	5.86	8	7	4	22	9356017	1.542313	198.3167
Jan	2015	52.9	10.25	7.17	7.75	6.75	4	22	10846907	1.698012	206.3167
Feb	2015	51.2	10.25	6.30	7.75	6.75	4	21.5	8414733	1.698012	200.2167
Mar	2015	52.1	10.25	6.28	7.75	6.5	4	21.5	9967725	1.698012	220.1667
Apr	2015	51.2	10.25	5.79	7.75	6.5	4	21.5	7381059	1.955176	195.2667
May	2015	52.4	10	5.74	7.75	6.5	4	21.5	7863679	1.955176	191.7167
Jun	2015	51.3	10	6.10	7.25	6.25	4	21.5	7157999	1.955176	194.65
Jul	2015	52.6	10	4.37	7.25	6.25	4	21.5	9494957	1.898831	197.0833
Aug	2015	52.3	10	4.35	7.25	6.25	4	21.5	9880286	1.898831	192.9167
Sep	2015	51.2	10	5.14	6.75	5.75	4	21.5	9160210	1.898831	197.5833
Oct	2015	50.8	9.95	6.32	6.75	5.75	4	21.5	8469180	1.842798	199.1833
Nov	2015	50.3	9.7	6.72	6.75	5.75	4	21.5	7548431	1.842798	173.8833
Dec	2015	49.1	9.7	6.32	6.75	5.75	4	21.5	7854824	1.842798	196.5
Jan	2016	51.1	9.7	5.91	6.75	5.75	4	21.5	9292779	2.113006	199.6167
Feb	2016	51.1	9.7	5.53	6.75	5.75	4	21.5	12746101	2.113006	202
Mar	2016	52.4	9.7	5.51	6.75	5.75	4	21.5	13095677	2.113006	216.55

Comparison & Interpretation

- To study the long-run relationship of monetary policy Key rates with PMI. To calculate this, the formula used is Auto Regressive Distributed lag Method

$$y_t = a + w_0 x_t + w_1 x_{t-1} + w_2 x_{t-2} + \ldots + \text{error term}$$

or the form

$$y_t = a + w_0 x_t + w_1 x_{t-1} + w_2 x_{t-2} + \ldots + w_n x_{t-n} + \text{error term},$$

Using the Key rates and PMI apply this formula in the E-views we get the below result.

TABLE 3

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-0.001046	0.022724	-0.046015	0.9634
D(CRR(-1))	0.008467	0.100656	0.084123	0.9331
D(CRR(-2))	0.000903	0.117646	0.007678	0.9939
D(CRR(-3))	0.124719	0.125094	0.997002	0.321
D(CRR(-4))	0.284644	0.117306	2.4265	0.0169
D(REPO(-1))	0.645436	0.278593	2.316774	0.0224
D(REPO(-2))	0.719625	0.279626	-2.573529	0.0114
D(REPO(-3))	0.327515	0.198018	-1.653961	0.101
D(REPO(-4))	0.305825	0.206681	-1.479695	0.1418
D(REVERSEREPO(-1))	0.580303	0.276645	-2.097647	0.0382
D(REVERSEREPO(-2))	0.73848	0.291542	2.533014	0.0127
D(REVERSEREPO(-3))	0.28079	0.233035	1.204928	0.2308
D(REVERSEREPO(-4))	0.24128	0.237258	1.016953	0.3114
D(LPMI(-1))	-0.010911	0.008581	-1.271557	0.2062
D(LPMI(-2))	-0.021776	0.007943	2.741427	0.0072
D(LPMI(-3))	-0.013465	0.007834	-1.718692	0.0885
D(LPMI(-4))	-0.002672	0.007808	-0.342173	0.7329
R-squared	0.616666	Mean dependent var		-0.00352
Adjusted R-squared	0.245412	S.D. dependent var		0.274532
S.E. of regression	0.238478	Akaike info criterion		0.171229
Sum squared resid	6.199014	Schwarz criterion		0.858146
Log likelihood	20.84275	Hannan-Quinn criter.		0.450364
F-statistic	2.433028	Durbin-Watson stat		2.026295
Prob(F-statistic)	0.000347			

Interpretation: The above table depicts the auto regressive distributed lag methodology to measure the long run association of PMI with monitory policy key rates. The study result reveals that production manager index is having long and also short run association with all the key policy rates because the coefficient values were observed negative in 4 lags.

- To know the monetary policy key rates influence on PMI.

To calculate this, the formula used is Johansson co integration test.

$$X_t = \mu + \Phi D_t + \Pi_p X_{t-p} + \cdots + \Pi_1 X_{t-1} + e_t, \quad t = 1, \ldots, T$$

Using the Key rates and PMI apply this formula in the E-views we get the below result.

TABLE 4

Data Trend:	None	None	Linear	Linear	Quadratic
Rank or	No Interce	Intercept	Intercept	Intercept	Intercept
No. of CEs	No Trend	No Trend	No Trend	Trend	Trend
	Log Likelihood by Rank (rows) and Model (columns)				
0	21.31603	21.31603	23.0321	23.0321	28.23287
1	33.70782	34.27575	34.71143	38.24465	41.58271
2	38.70698	45.19505	45.37508	48.91594	49.80646
3	39.12463	49.23054	49.23054	52.96535	52.96535
4	-35.2356	-35.2356	-35.1231	-35.1231	-34.597
5	-24.5378	-20.8838	-20.7714	-19.2004	-18.6874
6	-17.9786	-14.3122	-14.2063	-11.0643	-10.6367
7	-17.846	-9.59708	-9.59708	-6.44924	-6.44924
	AIC				
0	-0.54738	-0.54738	-0.49032	-0.49032	-0.58813
1	-0.83146	-0.81226	-0.74273	-0.85532	-0.91479
2	-0.78698	-0.98645	-0.95	-1.018486	-1.01362
3	-0.53887	-0.85469	-0.85469	-0.88735	-0.88735
	SIC				
0	-0.18605	-0.18605	-0.00854	-0.00854	0.014093
1	-0.229238*	-0.16989	-0.02007	-0.09251	-0.07168
2	0.056132	-0.06304	0.01355	0.025363	0.070377
3	0.545125	0.349751	0.349751	0.437537	0.437537

Interpretation: The above analysis of Johansen co integration been applied between the monetary policy key rates and PMI. The Johansen co integration test results reveals that the log likelihood values in both non linear and quadratic intercept trend values found to be increasing mode in both Alpha levels and hence the data is said to be co integrated.

➢ The below result is found by using granger causality test.

Formula for granger causality test is

$$\mathbb{P}[Y(t+1) \in A \mid \mathcal{I}(t)] \neq \mathbb{P}[Y(t+1) \in A \mid \mathcal{I}_{-X}(t)],$$

and the values used are monetary policy key rates and PMI

TABLE 5

Null Hypothesis:	Obs	F-Statistic	Prob.
PMI does not Granger Cause CRR	46	0.03331	0.9673
CRR does not Granger Cause PMI		1.1518	0.3261
PMI does not Granger Cause DREPO	45	5.54315	0.0075
DREPO does not Granger Cause PMI		0.70133	0.5019
PMI does not Granger Cause DREVERSEREPO	45	5.54315	0.0075
DREVERSEREPO does not Granger Cause PMI		0.70133	0.5019
PMI does not Granger Cause DSLR	45	2.4578	0.0985
DSLR does not Granger Cause PMI		0.28251	0.7554

Interpretation:- The above analysis of Granger causality test has been applied and the null hypothesis results reveals that CRR, repo rate, reverse repo rate and SLR P values were found to be non significant because P values were observed more than more than 0.05. Hence the alternative hypothesis H1 has been accepted all the monetary policy key rate of CRR, repo rate, reverse repo rate and SLR influencing the PMI.

➢ To study the PMI impact on IIP and GDP.

To calculate this, the formula used is 2 way Annova.

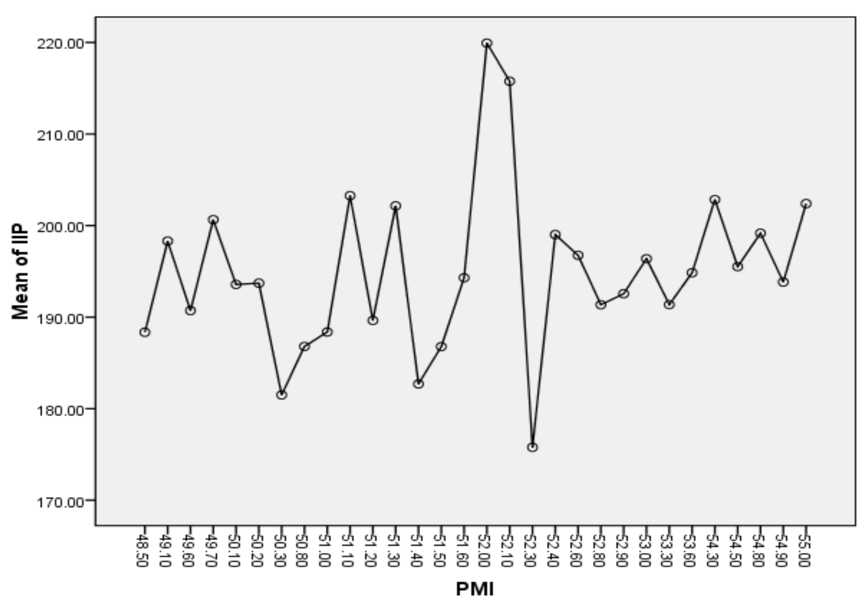
Using the Key rates, IIP and GDP apply this formula in the SPSS we get the below result.

TABLE 6

				Sum of Squares	df	Mean Square	F	Sig.
GDP	Between Groups	(Combined)		2.044	29	0.07	2.94	0.01
		Linear Term	Weighted	0.609	1	0.609	25.399	0
			Deviation	1.435	28	0.051	2.138	0.048
		Quadratic Term	Weighted	0.543	1	0.543	22.627	0
			Deviation	0.893	27	0.033	1.379	0.242
	Within Groups			0.432	18	0.024		
	Total			2.476	47			
IIP	Between Groups	(Combined)		2893.289	29	99.769	0.576	0.909
		Linear Term	Weighted	111.704	1	111.704	0.645	0.432
			Deviation	2781.585	28	99.342	0.574	0.909
		Quadratic Term	Weighted	0.051	1	0.051	0	0.987
			Deviation	2781.534	27	103.02	0.595	0.892
	Within Groups			3115.434	18	173.08		
	Total			6008.723	47			

Interpretation:- The above table of linear regression model result reveals that GDP is influenced by the PMI because the probability value is found to be significant as the key value is 0.01 which is less than 0.05 the IP probability value with PMI is observed to be non significant because the P value is 0.909 greater than 0.05 hence the PMI is not influencing the IIP during the analysis period.

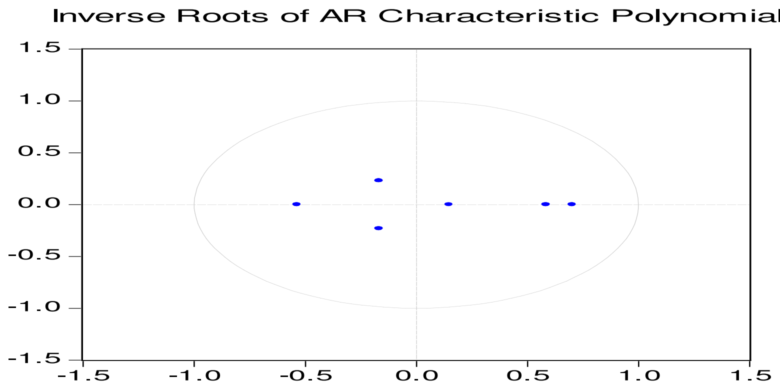
FIG. 1



Interpretation:- The above graph of linear regression trend line with GDP and PMI shows that the influence of these two variables is observed in the middle period as a trend line moved upward and downward in the middle range.

4. To predict the future moment of IIP and gold price based on PMI.

FIG. 2



Interpretation: The above polynomial graphs indicate that Universe roots of PMI, AP, gold are fallen inside the circle, which indicates that the data is stated to be normally distributed.

- To calculate this, the formula used is Jarque-bera.

$$JB = \frac{n-k+1}{6}\left(S^2 + \frac{1}{4}(C-3)^2\right)$$

Applying this formula we get the below result

TABLE 7

Compone	Jarque-Bera	df	Prob.
1	4.152543	2	0.1254
2	2.542287	2	0.2805
3	0.802473	2	0.6695
Joint	7.497302	6	0.2773

Interpretation:- The above table of jarque bera test has been applied to find data is normally distributed are not the P value is 0.2773 which is less than 0.5 for the joint component. Hence the Data stated to be normally distributed.

- To calculate this, the formula used is Vector auto regression model(VAR).

$$y_t = c + A_1 y_{t-1} + A_2 y_{t-2} + \cdots + A_p y_{t-p} + e_t,$$

Applying this formula we get the below result.

TABLE 8

	PMI	IIP	DGOLD
PMI(-1)	0.654415	2.071004	273817.1
	-0.16483	-1.81093	-506538
	[3.97013]	[1.14361]	[0.54057]
PMI(-2)	0.021042	-2.21346	69180.58
	-0.15275	-1.67812	-469390
	[0.13776]	[-1.31901]	[0.14738]

Interpretation:- The above table of VAR model has been applied to predict the future movement based on PMI the analysis result reveals that the IIP is expected to go down in the near future because Coefficient value is -2.2134 the gold price is expected to go up is found to be positive.

- To calculate this, the formula used is T-test.

$$t = \frac{\bar{X}_1 - \bar{X}_2}{\sqrt{\frac{S_1^2}{n_1} + \frac{S_2^2}{n_2}}}$$

Applying this formula we get the below result.

ONE-SAMPLE STATISTICS

TABLE 9

	N	Mean	Std. Deviation	Std. Error Mean
IIP	60	195.24	10.91728	1.40941
GDP	48	1.7211	0.22952	0.03313
PMI	48	51.9271	1.55176	0.22398

ONE-SAMPLE TEST

TABLE 10

	Test Value = 0					
					95% Confidence Interval of the Difference	
	T	df	Sig. (2-tail	Mean Difference	Lower	Upper
IIP	138.527	59	0	195.24222	192.422	198.0625
GDP	51.952	47	0	1.72111	1.6545	1.7878
PMI	231.84	47	0	51.92708	51.4765	52.3777

Interpretation:- The above table of one sample t-test depicts the significant change between the variables the mean difference has been observed between upper and lower confidence of internal of 95% all the P values per IIP,GDP and PMI is found to be significant.Hence the analysis proved that all the three variables influence change has been found.

LIMITATIONS OF THE STUDY

1. The PMI data is available from 2012 onwards in India so the analysis has been Limited only for 4 years the production activity depends on overall economy which is vast hence the output of this study may not give the perfect picture.
2. IIP data calculation methodology has been changed in the year 2012.But in the base year 2004 and 2005 has considered.
3. Consumer Non-durable data has not been considered in IIP data calculation.
4. CPI calculated Inflation data has been considered for the study.

FINDINGS

1. It has been found all the key monetary policy rates are influencing the PMI during analysis period.
2. The linear regression model found that PMI is having influence on GDP but it had failed to influence IIP.
3. The study observed that PMI is predicted to go down side in the near future based on PMI but the gold price expected to go up.

SUGGESTION

1. The studies suggest that GDP is expected to go down side based on PMI. Hence, there is a need to focus on manufacturing sector so that GDP growth will not be effected.
2. Many countries central banks are offering interest rates on CRR but in India RBI are not offering interest rate but banks are paying interest to the deposit holders. The study suggests offering interest rate to the banks on CRR.
3. Raise of inflation may dampen the GDP growth rate, hence the study suggest the RBI to manage the monetary policy to keep the control on inflation.
4. There is a need to decrease the SLR further down to easy off the liquidity in the system so that growth rate will not be effected due to tight liquidity.

CONCLUSION

This study has been concluded for the title monetary policy impact on PMI. The production manager index information gives the overall industrial production activities so that future outputs can be analyzed. Production activity plays a crucial role in growth of economy but due to uncertainty in the system liquidity crunch may take place. In order to maintain the momentum of economy monetary policy will act as life line. The RBI monetary policy key rates will be targeted towards IIP and PMI by maintaining the liquidity but production manager index will be the base to take the decision so that economy Momentum will continue smoothly. The present study has been done how monetary policy is influencing the PMI and its associate economic variables and observed that the PMI is getting influenced by the key policy rates hence there is a further scope to do research in the area by considering external factors influence on PMI So that industrial output will be predicted in the proper way.

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