Chapter I

Chapter I

Introduction

I.1 The Concept of Causality

The dominating theme of this chapter is to understand the widely known concept of "Causal explanation", (cauasality) and to find out how this concept developed over a passage of time. Broadly speaking, the concept of causality has a lot many meanings. W.K.Clifford explains that the word represented by "Cause" has sixty four meanings in the writings of plato and forty-eight in those of Aristotle.[1] However four principal meanings of the word were outline by Aristotle long ago,[2] They are,

1) Efficient cause, OR by which change is Wrought
   (Worked in to shape by effort)
2) Final cause, or purpose for which is wrought.
3) Material cause, Or that in which a change is wrought and
4) Formal cause, OR that into which something is changed.

In terms of the much quoted-example of the sculpture "The material cause of a statue is the marble, the formal cause is the essence of the statue to be produced, the efficient cause is the contact of chisel with the marble and the final cause is the sculpture as in view"

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1. See McClelland.Peter.D. "Causal explanation and model building in History, Economics and New Economic History. chap.1.p 32, cornell university press, Ithaca and London.
2. See McClelland.Peter.D. "Causal explanation and model building in History, Economics and New Economic History. chap.1.p 32, cornell university press, Ithaca and London.

But, in the past few centuries, final, material and formal causes have tended to fall into disuse. The sole survior efficient cause has in the past Newtonian era acquired rather special connotations. Aristotal pointed out that teleological interpretation assumes that the future state of affair determines the way in which the present affair is unfolded. Therefore, there is nothing much in having just empirical knowledge of succession and coexistence of phenomena. As matter of fact, such knowledge must highlight the central point and must establish the fact on the basis of evidence or displaying, Aristotle thought a satisfactory explanation of phenomenon must utilise the predicates of that science to which the phenomenon belongs.[3] A specific effect is as result of specific cause. However as already mentioned in the twentieth century causal explanations tend to be concerned only with efficient causation and are therefore ruled by the central principle of efficient causation. In other words similar cause similar effect. The implication is that causal explanations consist of subsumming specific facts under generalization that link causes (A) to effects (B) in statement of general form i.e.

If (A, ... An) then B

But J.S Mill had something else in his mind about the concept " Causality " He strongly believed that causation should be distinguished from accidental correlation. In causal relation three attributes have to be fullfilled.

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3. See Karkal G.L."A Note on philosophical foundations of causality "**Prajnan**" Journal of Social and Management science, National Institute of Bank Management. Jan - March 1986 Vol. XV No.1 P 98

I) It is true of every instance

II) It is the part of the subject precisely and not a part of a large whole and

III) It is essential to subject,

Hence, cause is a uniform antecedent of phenomenon i.e. if A in, if A than 'B' means that there is some necessary connection between the two events; such that given event 'B' and earlier event 'A' could be discovered which stood in certain relation (and not just coinsidences) to 'B'. Through the methods of agreement one can discover a scientific law but the method of agreement is possible only on the basis of antecedent hypothesis about the relevant circumstance. David Hume, the philosopher believed that causal knowledge is only a knowledge of the de facto association of two classes of events. According to him, our visual impression allows us to observe constant conjunction that things of type 'A' are always followed by things of type 'B'; but never connected.[4] David Hume tries to explain, that, to establish necessary knowledge of a sequence of events; one should prove that sequence could not have been otherwise. If causal relation indicates constant conjunction and necessary connection then it is not possible to achieve causal knowledge. We can just establish is that events of one type invariably have been by events of second type. Hence causal knowledge is only of the de facto association of two classes of events.

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4. See McClelland Peter D "causal explanation and Model building in History Economics and New Economic History" p 36

But, the well-known philosopher Descartes felt that, real knowledge is based on causal relation, rather than mere senses. Because, he believed senses may give illusory ideas. But the idea of cause emerges as we see to the events follow one another and deduce that first event has given rise to the second.

According to, philosopher Nicolous a necessary knowledge of causal relations cannot be obtained by mere arguments. No information can be deduced from a set of premises except that information is implied by or contained in premises. He explains that, since cause is something distinct from its effects, one cannot deduce a statement about an effect from a statement about its supposed cause, it may be deduced from more than one set of premises. Hence, the relation between various objects, events and expression of relation must have the status of necessary truths. But Nicolous failed to determine what kinds of statements are necessary truth.

According to Bacon, a search for the final causes of phenomena[5] leads to purely verbal disputes. He explains that a search for explanatory hypothesis involves four regulative principles.

A) Admit no more causes of things, than that are both true and sufficient to explain their appearances.

B) As far as possible asssign same causes for same effects.

C) Qualities which admit neither intensification nor remission are universal qualities and

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5. See Karkal G.L. "A note on philosophical foundation of causality prajnan journal of social and management sciences" Jan-March 1986 Vol. XV, No.1, p99

D) Propositions inferred by general induction from phenomena are generally true. Bacon pointed out that it is difficult to specify criteria for identification of true causes, even though they should be represented in theory. i.e. theory should be supported by inductive evidence from an analysis of diverse types of phenomena. Thus Bacon is not clear in his mind about criteria for identification of true causes, which create specific effects. One view point insists that causation implies only regression. Although regression analysis deals with the dependence of one variabel on other variabels, it does not necessarily imply, causation. In the words of Kendall and Stuart, "A stalistical relationship however strong and however suggestive can never establish causal connexion: our idea of causation must come from outside statistics, ultimately from some theory or other"[6] One view point is that causation is synonymous with correlation but existence of correlation between two variables does not necessarily imply that one is the cause of the movement in the other or correlation does not necessarily imply causation

During the past few centuries, various Indian Schools of thought, also provided various explanations concerned with "cause and effects". Few of these schools of thoughts regards concept cause and effect" as universally unreliable, incomplete, imaginary and away from final truth i.e. Char Vaka (Materialistic) school of thought in India, strongly believes perception(i.e. pratyaksha) is the only source and criterion of knowledge of cause and effect. Inference whether of deductive

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6. See "Kendall and Stuart" The Advanced theory of Statistics" Charles Giggen publishers, New York, 1961 vol.2 capt 26. p. 279.

or inductive nature and testimony are not a valid and reliable source of knowledge. Therefore, to formulate theory, there is no basis for our thinking and claiming that future (event) will be like the past, but it is only assumption and because of this an inferred proposition cannot be reliable (of cause and effect) As a matter of fact, 'inference' is arguing in a circle and begging the question. Hence, inferred proposition does not provide any new knowledge, it does not exist in the original proposition. This is the reason for invariable connection between two events turns in to completely ineffective arguments and misleads in establishing the universality of the proposition. We don't have enough grounds in our experience for jumping from statements of narrow perceived instances to unlimited, broad, unrestricted universal generalization. Thus the materialistic school of thought in India concluded that, there is no such thing as knowledge, universal truth of cause and effect. This school of thought also argue, that accepting something as the universal truth on the basis of testimony of others, presupposes that, it is reliable But there is no ground to justify such pre-supposition. Hence the testimony of somebody cannot be considered as universally reliable, just on the basis of past experience (cause and effect.)

According to the Jain school of thought, conjunction process between two events is partial truth, cannot be equal to absolute truth (cause and effect).Because Jain school of thought in India believes that knowledge is of two types (i) Mediate and (ii) immidiate. Mediate means "paroksha" like empirical knowledge

by direct perception. But mediate knowledge is partial and relative to one's point of view about the particular aspects or events. Hence cause and effect failed to reflect absolute truth. Immidiate (aparoksha) knowledge is non conceptual and non perceptional. Thus the Jain school of thought regards cause and effect (Conjunction process between two events) as subjective and not absolute truth.

However, according to Buddhism there is always change and universal changes, but we do not perceive this because of languages and thought, words and symbols are held constant in time, in terms of their meaning in order to facilitate communication and thought. Universal change is based on the doctrine of dependent origination, i.e. nothing exists (happens) unconditionally and absolutely (i.e. if 'A' arises, 'B' arises if 'A' ceases 'B' ceases) Hence the objects of our experience exist because of its conditional existence, it produces some effect.

But, just the opposite thought is provided by Indian 'sankhya' and 'vedanta' theories. Sankhya theory explains that if at all effect does not preexist in its material cause, then effect is a new creation, otherwise not, one cannot say that it is caused. Again the question arises whether effect is real transformation or unreal of its cause. obviously, if effect does not preexist in its cause then it is non entity and never be produced. Hence effect is a sign of its material cause. Hence cause and effect are explicit and implicit stages of the same process. They cannot be treated, different from each other. Indian vedanta theory explains that, although effects preexist in cause if cause undergoes a real transformation in bringing about a charge (effect) then transformation may not be real, but if

cause brings real charge (effect) than effect cannot preexist in cause. Hence, cause producing effect means that there is no real change in substance or in form, is only an apparent change in form. Indian "nyaya theory" regards that a cause is an unconditional and invariable antecedent of an effect and effect is an unconditional and invariable consequence of a cause.[7] Moreover ,the same cause produces the same effect. This theory ruled out remote cause and regards that cause and effect cannot be produced by any other cause. An effect is non-existant before its production. i.e.it did not preexist in its cause, it is distinct from its cause and can never be identical with it.

However, through out the world most of physicists did not agree to chain of events preceding effect. Most of them were satisfied with functional dependence between variable rather than cause and effect, physicists were too much bothered about what is preceding just before event. However, they had to reintroduce the "cause and effect" to be realistic in life and for the soundness of science.

According to empiricists experience by itself says nothing about any causal relation and they regarded causality as a poor theory of change. They firmly believes that causal chain is the product of our imagination.

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7. See **Prajnan"** journal of social and management Sciences Jan- March 1986 p.96

Thus concept causality has been twisted in their own way by western thinkers Aristotle, J.S.Mill, David Hume, Descarates, Nicolous, Bacon and by Indian schools of thought and others.

However with David Hume and J.S.Mill we come across the idea that two events 'A' and 'B' are related as cause and effect in prticular condition i.e.

(1). They are contiguous in space and time.

(2) 'A' preceds 'B' and

(3) 'A' is followed by 'B' without fail.

Thus J.S.Mill provided a simple explanation about concept causality. But J.S.Mill's explanation is unralistic as well as incomplete, Because his total concentration is on two events without thinking about other relevant conditions. This definitely take one to inadequate and misleading genralization, since set of causes produce result. J.S.Mill's explanation is related with necessary conditions instead of sufficient conditions. Therefore, one should consider the total of the conditions which preceded an events; conditions that occured indefinitely in the past. However, J.S.Mill's explanation helped to understand necessary conditions related with concept casuality.

After coming across the thoughts and explanations of western and Indian thinkers, the arguments on the concept causality have divided thinkers in three broad groups. They are known as (1) Causalists (2) Semi-Causalists and (3) acausalists.

According to the thoughts of 'Causalists', all events are caused and there is nothing without cause. Every cause must have an effect and every effect a cause.

According to the semi-causalists school of thought 'cause and effect' has limited range of operation. They do not reject the concept of causality completely. Their argument is cause and effect are of recurring and non-unique type of of phenonmena then it would not be difficult to show that some causes and effects are non-identicals in social sciences, life sciences. Hence in these sciences there are non-causal categories of determination (linkage) of events or process.

But the 'acausalist'school of thought completely disagrees to the very idea of 'cause and Effect'. It is loosely known as Nihilistic or Skeptic meaning that the link between cause and effect is a myth. There is irrationalism in the world.

Inspite of semi-causalists and acausalists argument; over a passage of time concept causality and causal analysis attracted,steadily to almost all types of scholars including in the field of economics (Herman Wold 1954, Simon 1953, M.Friedman 1963, J.R. Hicks 1979).

To quote,J.R.Hicks,causality is a matter of explanation in a statement of causality the theory is being applied. J.R.Hicks finds that economic application of causality is quite enlightening.[8]

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8. See McClelland Peter D "Causal explanation and model buildings in History, Economics and New Econbmic History" chap I, p 46 cornell University Press, Ithacha and London.

1.2 The idea and Rationale of Causality Analysis

The most widespread attitude of deciding that one thing causes another is the simple principle: post hoc, ergo propter hox "After this, therefore because of this". This kind of an approach to causality could be traced way back to the philosophical literature (Wold 1954[9], F.Waismann 1960[10])
The primary concern of the philosophers had been with the clarification regarding cause and effect and the formulation of the law of causality in a more precise manner. They thought that this kind of an approach would render valuable insight into the sort of validity, which would usually be claimed for the idea of causation.

With David Hume and J.S.Mills, for example, we meet the idea that two events C and E are related as cause and effect if they fullfill certain conditions, namely if (i) they are contiguous in space and time (ii) C preceds E and (iii) C is unfailingly followed by "E". The law of causation, the recognition of which is the main pillar of inductive science, is but the familiar truth, that invariability of succession is found by observation to obtain between every fact in nature and some other fact which has preceded it (J.S.Mills)[11]

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9. Wold (1954)"causality and Econometrica". pp. 162-77

10. Waismann(1960)"The decline and fall of causality" in "Turning points in physics" North Holland publishing company. Amastardam, chapter v. pp 84-154.

11. See for Hume David and Mills J.S. "Casual explanation and model buildings in History, economics and New Economics History by McCle 11and Peter D. pp 35-40

However, the preceding ideas about causality, though simple and appealing, seems to be quite inappropriate in as much as that they singularly concentrate only on two events without considering other relevant conditions.

In fact , this kind of reasoning often leads to a faulty generalization, since usually a combination of causes produces a result. Ordinarily, when one speaks of cause, one means the proximate or immediate cause. However, a complete statement of cause would necessitate the distinction between both necessary and sufficient conditions, and in that sense, would comprise the sum total of conditions which preceded an event, conditions stretching back indefinitly in the past.

An analogous idea of physicists would be that of functional dependence i.e. what takes place at a certain point at a given time depends entirely upon what has been happening in the immediate neighbourhood. "just before", However , the idea of functional dependence, atleast to the physicists, does not imply the causal link but merely a correspondence between the values that the variable may take. The basic fallacy in the approach of philosophical writers, according to the natural scientists is their preoccupation with the formulation of the "uniform" relations between the events. However, the events as such are without interest to the scientist. In fact, the scientist discovers physical laws through recognition of functional dependencies between the variables primarily by analysis and synthesis, and finally these very physical laws take the place of the relation between cause and effect and make it redundant to analyse the relation any more precisely. Instead of establishing

connections between facts as such, science endeavours to comprehend reality by dissecting it into components or elements (which are simpler, recurrent and capable of measurement yielding unambiguous , simple laws F.Waismann 1960)Despite this redundancy rendered to the idea of causality by physics , it is reinforced time and again that the term "cause" and "effect" and the observation of regularity with which they follow each other are very useful in practical life and in the infancy of science. As mentioned earlier, the earliest attempts of the philosophers, though not successful, paved the way for a more articulated discussion and the vast shift of perspective, out of which a much clearer picture of causality was to emerge in science. Apart from the uncertainty surrounding the concept, since its inception, the importance of the concept has spread slowly and gradually to other fields including economics. (Herman Wold 1954, Simon 1953 J.R.Hicks, 1979).

To quote Hicks, "Causality is a matter of explanation ..... when theory is applied, it is being used as a means of explanation (hence) in a statement of causality the theory is being applied". J.R.Hicks finds the economic application of causality quite instructive.[12]

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12. Hicks J.R."The New Causality An Explanation" Oxford Economics Papers 1984.vol.36 pp 12-15

With economic knowledge being quite imperfect and uncertain, the causality analysis (viewed at best as a method of research) would be rewarding in diminishing the degree of uncertainty of economic knowledge and also in rendering a much more precise and scientific content to the economic phenomena or the generalizations which are often found subject to errors and ambiguous interpretation. Besides an attempt to detect and establish causality between the variables seems to be legitimate on the methodological grounds. It is widely known that for any proposition to be scientific it must be falsifiable. This very feature of falsifiability implies that the proposition in question is capable of being tested. Over the years researches have evolved statistical tests to examine the relevance and validity of new theories and also to reexamine, the already accepted propositions. In this state of affair, social sciences are already proliferated with newer theories and development of too many stringent tests for adequate testing of hypotheses. Viewed in this way , the causality exercise would be an instrument to reject the unsuccessful hypotheses and also to question the confirmed validity of previously accepted hypotheses with the availability of more rebust tests. Besides, the exercise would also examine the proposed hypotheses more precisely and would determine the extent of the confidence that should be attached to the hypotheses.

I.3 Theoretical Underpinning

In economic literature ,theoretical foundation of monetary policy is indispensable. Obviously,therefore,any statement of causality should have reference to a theory;the events to be related causally should be fitted in to theory or alternatively the events are instance of theory . J.R.Hicks has made an analysis of causal laws,examined the role of economic theory in relation to causal relation.[13]

H.Feigl's splendid work on causality,reflects importance of economic theory in relation to testibility of causal relation.His concept of causation is defined interms of predictability according to law or set of laws.[14] This definition of Feigl,suggest two conditions,for a causal test,

i) Predictability and

ii) Law or sets of laws according to which prediction of yet unobserved events could be made.

H.Feigl's definition clearly indicats that, those tests which are linked to predictability but not according to law (s),are not causal tests. Thus,his definition of causality highlight the importance attached to the laws (theory) in his definition of causality.

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13. See Hicks.J.R. 'The new causality An explanation,Oxford, economic paper 1984 vol.36.pp 12-15

14. Fegil"Notes on causality" in Fegil H and Brodback. P(Eds) Reading in the philosophy of science,New York,Appleton century croft Inc 1953.

H.Feigl has clearly classified the characteristics of laws in to;

1) type of laws - Statistical

2) form of laws - Qualitative OR
Semi- quantitative - or full quantitative;

3) domain of laws- temporal (sequential) or
co-existential (simultaneous); and

4) level of laws- Macro or Micro, these causal laws are
essentially non-deterministic.

However Simon H.A. characterises causal relations as good as "model building"[15]. He characterises causal orderings as simple properties of a model the properties that are subject to changes as the model, is alter to fit new observations. His notion about causal ordering is related to model's characteristics and nothing to do with the empirical features of the real world[16]. Thus, there is a difference between the explanation presented by H.Feigl and Simon H.A. While Simon's concept is mainly, a decription of laws characterizing a model and Feigl's definition indicates, predictions about empirically observable events in 'real world'. Therefore , a law which is a causal in Simon view is not a causal according to Feigl. H.Feigl strongly believed that a law which is not capable of predictions in 'real' world may not be regarded causal in empirical sense.

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15. Simon H.A. " On the definition of causal Relation" Journal of philosophy, 1952. Vol. 49 pp 517-27

16. Kamaiah Bandi, etal" Foundation and Test of Causality" A Review, see 'Prajnan" journal of social and managemet sciences' Jan-March 1986 Vol.XV No. 1 pp. 78.

But Strotz and Wold explanation, regarding, causal relationship speak neither about law nor about predictability. They explained it interms of controlled changes in variables. According to them, 'A' is cause of 'B' if by hypothesis, it is or would be possible by controlling 'A' indirectly to control 'B', at least stochastically.[17] At the same time, it may or may not be possible, by controlling 'B' indirectly to control 'A'. Stortz and Wold defined causality interms of controlled changes in variables.

Baseman R.L. assumed a mechanism which is free from non random external influence; such mechanis m is causal if when started from same intitial conditions always run through approximately the same sequence of states. But this type of experiments need not be feasible.

However, major contribution toward concpet causality and causal relationship came through Hicks J.R. Due to his important work the concept could achieve good degree of theoretical platform. No. doubt the contributions by philosophers Feigl H. Simon H.A. Basman R.L.[18] Strotz and Wold emphasized upon philosophical foundations of "causality". But Hicks J.R. has made an analysis

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17. Strotz, R.H. and Wold H.O.A. "Recursive Vs Non-Recursive system. An attempt at Synthesis" Econometrica, 1960 Vol 28. 28 pp 417-27

18. Baseman R.L. "The causal interpretation of non-triangular systems of economic relation" Econometrica 1963 Vol. 31 pp 439-40

of causal laws, examined the importance of economic theory in relations to causal relations and discussed about various kinds, of causality.[19] Hicks J.R. explained that 'Old causality' is different from 'new causality' His concept of 'Old causality' is related with action of either of human agent or a supernatural agent. His concept of 'new causality' referes to a system of thought. According to him 'new causation is important and meaningful in field of economics. Further he distinguishes 'weak causation' from "strong causation" He explained that if 'A' is one of the causes of 'B',than it should be regarded'as weak causation;.Further there are two types of weak causations separable and non separable causes. But, he explained if 'A' is the sole cause of 'B' then it is regarded as strong causation.

'Hicks J.R. has distinguished three types of causality.(i) Contemporaneous (ii) Static causality and (iii) Sequential causality.

In his contemporaneous-type of causality both 'cause and effect' are related to the same time period. Hicks J.R. has advised, the use of 'temporary equilibrium' method for analysis of contemporaneous causality. But, in this case difficulty is related with selection of the length of time period. In the static concept of the causality, both cause and effect are regarded as permanencies. Static causality has been regarded

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19. Hicks J.R. "The New causality" A explanation" Oxford economic papers.1984 Vol.36 pp 12-15 and see Hicks J.R.causality in economics,Becil Backwell Oxford 1979.

by Hicks J.R. as a limiting case of contemporaneous causality in which the time period (for, the operation of cause to produce effect) has stretched to infinity. However this type of limiting conception alters the overall character of static causality. In the sequential causality the " cause always precedes effect in historical time". This type of causation involved two steps. In the first step causation is from the objective cause to the decisions which are based (influenced by) on it. In the second step causation is from decisions to their final effects. However, there may be time lags working in both the steps.

Hsieh and Manjun pointed out that, while ideas of the classical economic like A. Smith, Ricardo, and Malthus could be understood interms of static causality, those keynes and to some extent Alfred Marshall interms of contemperaneous causality. Similarly Grangers methodology is also case of static causality.[20] Hicks J.R.'s main preoccupation was with problems empirical as well as theoretical which arise with use of notion of causation in the context of social sciences.

Since mid-sixties, theoretical foundation of monetary policy in economic literature has been strongly advocated by theoretical as well as empirical studies of the monetarists (Friedman M and Meiselman 1963)[21] BY

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20. Foundation and tests of causality 'A' Review'by Bandi Kamaiah Bandi etal 'Prajnan' journal of Social and management sciences Jan March 1986 Vol. XV No. 1 page 81.

21. Friedman M and Meiselman D.I. (1963) The relative stability of monetary velocity and investment multiplier in United States'1887-1958 in commission on money and credit stabilisation policies, premtice-hall England wood (lifts)

that time monetarists, a body of macroeconomic thought, were definite about existence of strong and reasonably stable correlation between change in the money supply and in the amount of national income. Milton Friedman and Anna Schwartz found evidence that money, it's rate of change tend to 'lead' income in some sense.[22] Monetarists notion was based upon empirical observations and actual study reflecting a causal relation running from money to income. It is universal fact, that changes in Monetary Aggregates (M_1 M_3) cause ample effect on the economic activity. In this context, central proposition is that, the demand for money is demand for real balance and is empirically well-established stable endogenous function of few variables. M. Friedman argued, people every where are remarkbly consistent in the real quantity of money they choose to hold : the amount is similar over the decades and between countries with different economic and political institutions, Further, nominal quantity of money is exogenously determined by the monetary authorities. Therefore Friedman agreed to proceed from the assumption that the money supply is determined exclusively by monetary authorities and he stated bluntly that supply of money can be taken as autonomus variable for empirical work. He also pointed out that change in money stock are a consequence as well as an independent cause of change in income and price, though once they occur they will in their turn produce still further effect on income and prices. Friedman, stated that for there is much evidence that even during business cycles the money stock played a largely independent role.

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22. See Friedman M. and Schwartz. A 'Money and business cycles'

'Review of Economics and Statistics (Suppl) Feb.pp30-64

With this it is understood that the discrepancies between these two magnitudes are largly reflected in real output and prices i.e. nominal income.[23]

However many researchers have found demand for money to be stable function of few variables for Indian economy (M.S. Trivedi 1980)[24] Similarly M.Friedman confirmed that , in countries with less developed financial institutions, income held in currency by community is high,but, although different in size it is still astonishingly stable[25] .

This confirms that demand for money is stable in practice as well as in theory in less developed country like India.Togather with this empirical result,the notion (assumption)of exogenous money supply or monetary base could allow a simple statistical association between 1) Stock of money to GNP,2) Stock of money to Wholesale prices, 3) High powered money to supply of Money and 4) since 1951 to 1988 in Indian economy.

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23. See Nobay AR's introduction to money and economic activity in reading in British Monetary economics (1972) ed Johnson H.G.and a committee of monetary study group.

24. TRIVEDI M.S.(1980) Inflationary expections and demand for money in India (1951-75)India Economic journal 128(i) 62-76.

25. See Butler Eamonn
Millon Friedman "A guide to his economic thought" chapt.2 p.37 published by Gow publisling Limited,Gower House, Croft Road,Aldershot,Hants G U113 HR, England.

As a matter of fact, money to money income statistical association had been translated in causal sequence in India by DR. K.M. Joshi 1983[26]

In this connection, Phillip Cagan of Brown University made important study regarding "Determinants and effects of change in stock of money " 1875-1960, related, to U.S.A. economy.[27] In this study he discussed cause and effect relations among money price and output. This empirical work was summarized by him, in terms of correlation coefficient. Phillip Cagan found secular rate of changes in prices for 18 intercyclical subperiods from 1877 to 1954 was correlated closely with rate of growth of money stock. This supports hypothesis that money stock changes produced changes in prices. Moreover he pointed out that, implication of alternative hypothesis that direction of influence ran from prices to money is contradicted in two ways i.e.

1) The secular rates of change in prices and gold stock were, infact, correlated positively, not negatively, as alternative hypothesis requires.

2) Prices movements had substantially lower correlation with all non gold sources of change in money stock, singularly OR in combination.

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26. Joshi K.M. Money and Money Income causality, A case for India Chirag Book Distributors Baroda.

27. See Cagan Phillip. "Determinants and effects of changes in the stock of money", 1875 - 1960, chap.6 pp.234-76 National Bureau of Economic Research, New York, Distributed by Columbia University press, New York and London.

However, he also suggested, that, these result do not mean that prices had no effect on the determinants, but only that the effect were not found in right direction or of sufficient importance to account for high positive correlation with money stock. Phillip Cagan could not confirm direction of influence from prices to money stock. He also found that, nine-tenth of secular growth of money stock over the whole period (1877 to 1954) was accounted for, by expansion of high powered money and remaining one-tenth by decline in currency and reserve ratio.[28]

Thus Phillip Cagan used an analysis of details of the money supply determination to argue convencingly that the long run relation between money supply and price level cannot be due primarily to feedback from price level to money supply. His application of the same analythical technique to cyclical relations of money with income failed to yield firm conclusion. Phillip Cagan's empirical evidences supported unidirectional causal relation, between money supply and prices as well as income, rather than bidirectional causal relations between them.

Similarly a body of macroeconomic theory, the "quantity theory" explaind their empirical observation as reflecting a causal relation running from money to income.[29]

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28. See Cagan Phillip Determinants and effect of change in the stock of money , 1875-1960 U.S.A. p. 283

29. See Lucas and Sargent "Rational expectaions and Econometric Practice ". p.388 First published in 1981 by the George Allen and Unwin Ltd, 40 Museum Street, London WCIA iLV

Moreover M. Friedman and D. Meiselmann in their earlier study

regarded quantity and the keynsian theories as good as theory of the money income determination. They also noted that general comperative static income expenditure model can explain the fluctuation in price level or fluctuation in real income but not both at a time. Considering real income and price level as endogenous variable create the problem of number of unknowns exceeding the number of equations. To use a determinate model in this context need one more equation. M.Friedman tackled this problem of 'missing equation" by interpreting the Keynesian and Quantity theories approaches as providing alternative explantion for change in money income.[30] Now from general income expenditure framework (The IS-LM analysis) it can be shown, that if the demand for money is the completely interest inelastic and soely a function of income then changes in money income are caused by changes in nominal stock of money alone. On the other side, an infinitely interest elastic demand for money togather with completely inelastic investment demand would obtain a model in which changes in "autonomus expenditure" is the sole determinant of changes in money income. The former is simple Quantity theory model (velocity analysis) and the later is simple Keynesian model (Multiplier analysis). Making use of U.S.A. data M.Friedman and D.Meiselmann tested these two extreme versions and found the Quantity theory model out performs the Keynesian multiplier model.

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30. However it must be pointed out that once one relax the fix price assumption of Keynesian approach it turns out to be logically inadquate even as theory of money income.

" The empirical generalization is definite and discernible line between changes in the quantity of money in the economy and change in the level of prices or output is one which all monetarists concur"says Friedman.[31] However both M.Friedman and D.Meiselmann made an attempt to assess the empirical performance and validity of two models by testing the reduced forms. But,proper procedure in this context should have been to test the respective structural forms .As result, the evidence from M.Friedman and D.Meiselmann study has been not accepted. However,no doubt, that their study has provided insightful,if not conclusive evidence in this regards.

M.Friedman's critics found that the way 'nominal quantity of money'is defined is matter of dispute. Friedman uses a working definition of the money stock which is towards the narrower end of the spectrum of available possibilities.

This working definition is ths sum of currency plus all adjusted deposits in commercial banks. But the cirtics of Friedman disputed that there are many assets which do, or could be argued to,perform the functions of money. Hence, choice of definition,says Friedman's critics,would be crucial.Friedman's difinition of 'Money' seems to be rather arbitrary. Critics of Friedman strongly believed that, the supply of money defined narrowly in terms of currency for example, might perform entirely differently from the supply defined in terms of currency,plus bank deposits, plus savings deposits plus saving bonds and so forth, so first step must be to review the alternatives.

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31. See. Butler Eamonn Milton Freiedman 'A guide to his economic thought.chap.2 p.35

M.Friedman critics expressed the doubts about notion of exogenous money supply. Is money supply truly exogenous ? asked Friedman critics, James Tobin. Friedman's theoretical statement of the Quantity Theory of money was subjected to much criticism on the grounds that the supply of money is not a policy variable which could be completely controlled by, the monetary authorities. This is the criticism which is the modern but similar to the traditional 'banking school ' argument and it is nonetheless powerful today. Friedman's critic James Tobin, for example,has gone so far as to insist that the empirical evidence, including the cyclical pattern's of money and money income, could be explained equally well on, the assumption that the money supply is entirely 'endogenous' and not determined by the authorities at all.[32] Similarly the monetary theorists as Gurley and Shaw also pointed out that, money supply is not completely in control of the monetary authorities it depends partly up on how the banks adjust their portfolios of deposits and investments.

Phillip Cagan has suggested that the money supply is function not only of the monetary base (High powered money determined by the authorities),but of interest rates,income and other factors,which alter the proportion of money balances that public holds as cash. It is not the exogenous, controllable item which Friedman supposed it to be. According to Phillip Cagan business activity can change unpredictably the behaviour of banks and the public.And we cannot forsee changes in currency deposits

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32. Tobin.J.(1970b) "Money and Income: post hoc ergo propter hoc" Quartely journal of Economics, 84. May.pp 301-17

ratio of the public or the deposit/holding ratio of the banks, we cannot predict the net effects of the monetary changes on the economy.[33]

However, main dispute arose about direction of causation. Since the patterns of business activity and rates of changes in the stock of money are both cyclical, it could be suggested that direction of causation is the opposite to that Friedman has proposed. Critics argued that, instead of monetary changes causing subsequent movements in business activity, changes in level of business activity in fact call forth subsequent changes in the rate of growth of money stock. Friedman, however has replied that empirical tests strongly support treating the rate of changes of stock of money 'as conforming to the reference cycle positively with long lead, rather than inversely with some what shorter lag' which would be the alternative explanation. Moreover, there are in addition a number of simple cases which can be used to show the direction of causality; wartime inflations and some unanticipated large depression made it clear that business activity changes have followed monetary changes, not other way round. Over and above, observations of timing and amplitudes of cyclical variations in money and activity, when applied to the two opposing explanations, make it clear to Friedman, that monetary changes leads to changes in business activity, not the other way round. The work by Friedman and Meiselmann on the influence of monetary factors on business activity also tended to confirm this view. Some Keynesians such as Tobin have noted that, even if lag

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33. See Cagan Phillip determinants and effects of changes in the stock of money 1875 - 1960 U.S.A. chap 7 pp. 280-90.

between changes in money and other magnitudes does exists, it does not necessarily mean that money is the cause of disturbances; there may be some third factor which disturbed both.[34] But Friedman thought that the evidence admits no doubt on the issue, and when other factors are exogenously determined, when other factors are considered (Money supply as exogenously determined by authorities rather than being magnitude that simply responds endogenously to business conditions), the direction of causaton from money to business activity is clear enough.

But still, it is widely recognized that, no degree of positive association between money supply and income can be itself justify that variation in money supply causes variation in income and prices. Money might equally well-react passively and very reliably to variation in income or prices. This goes against unidirectional causal relation (empirical observation) from money to income established by M.Friedman's , argued James Tobin and Willam Brainard. They provided explicit example of possibilities for noncorrespondence between causal and temporal ordering of historically observed timing relations between turning points. Frank Deleeuw and John Kalchbrenner, argued that the monetary base (currency plus total reserves) is not properly treated as an exogenous variable in regressions equations because of the known dependence btween certain of its components and cyclical factors.[35]

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34. For this argument see Culbertson. J.M.'Friedman on the lag in effect of monetary policy'Journal of political economy, vol 68 (Dec.1960) pp 617-26.

35. See Lucas R.E.Jr and Sargent T.J. 'Rational expectations and econometric pratice chap.21 p.388

During 1970,"Bank of England quarterly Bulletin" pointed out that simultaneous relation between two variables through reduced form studies conveys very little about the direction of causal link.[36] Two series can be highly correlated because changes in first series are causing changes in second series or vice-versa or because some third factor is causing both series. The lead and lag relationship between money and money income would also not be necessarily indication of causality.

With the passage of time, researches in field of economics have developed and marshalled an impoising volume of statistical evidence of several types for measuring the relations between various economic quantities that are implied by underlying economic quantities that are implied by underlying economic theories. For example,historical case studies summary regressions of time series of economic agreegates (i.e. presumed effects are simply regrressed on presumed causes) the timing evidence specifically to leads and lags at cyclical turing points (Statistical correlation, turning A.Crockett,1970) and the new time series techniques (Granger,1969;Sims. C.A.1972,Haugh 1976) are the major approaches in the quest for stringent tests for testing of the theories.[37]

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36. Bank of England (1970), "Timimg relationship between movements of monetary and national income variables" Bank of England Quarterly Bulletin.Vol.10,No 4,pp 459 - 68.

37. Andersen,L.C.and Jordan J.L."Monetary and Fiscal actions a test of their rlative importance in economic stabilisation Federal Reserve Bank of St, Louis Review, Vol50 No.11 Nov. 1968

In these studies, the summary regression of time, series of economic aggregates (i.e. money supply and money income) carried an assumption of causal priority with the choice of dependent and independent variables and often high correlation or positive associations between these variables seemed to provided an inference for causality. However, this will not be proper if there is a two way relationship between movements in the stock of money and money income, price level, high powered money and government deficit with causal infulences running in both directions. Thus the investigations of the extent to which changes in money stock lead, lag or cause changs in money income and price level, high powered money and government deficit (or other way round) could be of considerable importance in any attempt to distinguish the main direction of causality.

I.4 Empirical studies regarding causality analysis

The recent widespread and intense interest in investigating causal relationships between various macroeconomic variables like Money and Income, Money and Prices, Reserve Money Money Stock and Money Multiplier, Industry Money Wages and Consumer Prices, Money and Index of Industrial Production helped lot many economists and researchers to test causal relationship through widely known "C.W.J. Granger Test"(1969) and "Cristopher A Sims test" (1972) C.W.J. Granger's work explaining causal relations by "Econometric Models" and "Cross- spectoral Methods" is available in publication " Rational expectations and Econometric Practice"

edited by Robert. E.Lucas and Jr and Tomas. J. Sargent.[38] Sims work, is available in same publication. However, antecedents of such sophisticated attempts could be traced back to few writings during 50's and early 60's (Orcutt 1952)[39] Simon 1953,[40] Wiener (1956),[41] strotz and Wold 1960[42] Basman 1963[43] Their early studies have been particularly related to the problem of determining causal interpretation of simultaneous equation system mostly with instantaneous causality without explicit discussion related to feedback.Those economists were mainly concerned with the form that the parameters of the equations should take, in order to detect definite causal relationships. Both Wold and Simon, for

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38. See Lucas and Sargent. Rational expectations and Economitric practice Chapt.20-21 pp371-402.

39. See Lucas and Sargent Rational expectations and Economitric practice Chapt.20 p.375. First published in 1981 by the George Allen and Unwin Ltd, 40 Museum Street London Wc IA ilu.

40. Simon H.A.(1953) causal ordering and Indentifiability in studies in Econometric method edited by Wood W.C. and Koopmans T.C.,Cowies commission Monograph 14 Newyork Willey.

41. Wiener,N.(1956) The theory of prediction. In Modern Mathematics for Engineers,Series 1,edited by E.F.Beckenbach Newyork: McGraw-Hill

42. Wold (1954) "Causality and Econometrics.Econometrica

43. Baseman R.I.(1963)"The causal interpretation of non-triangular system of economic relations "Econometrica 31 pp.439-48

example emphasized the importance of the notion of causality in the construction and use of theoretical models. According to them, direction is essential component in specification of causal relationship between a number of variables. Simon H.A.pointed out that, this types of specification render the relationship asymmetrical in the sense that on reversing the direction, the relationship is devoid of any causal meaning.Further, this idea of an asymmetrical functional relationship of Simon and Wold has stressed the idea of chain of causation in the development of recursive systems. Wiener N. has suggested an alternative theory wherein the stochastic nature of variables and direction of the flow of time are the central features. Essentially, Wiener's approach irrelevant for non-stochastic variables and it assumed that the future cannot cause the past. However, the idea of a chain of causation seems to be quite useful and appealing aspecially when one comes to analyse the underlying nature of economic model.

As mentioned, it has been systematically applied by Herman wold in the development of recursive (or causal chain) systems. A recursive model is one which displays following features.[44]

1) The recursive model refers to sequence of years, months, or any other time units.

2) All relations of the recursive model are causal with two types of variables, endogenous, which it is the purpose of the model to explain and exogenous variables which are auxilary. In every relation of the model the effect variable is thus endogenous while the cause variables are either endogenous or exogenous.

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44. Wold (1954)"Causality and Econometrics" Econometrica p.172

3) The model has only one causal relation for each endogenous variable.

4) Given the development of the exogenous variables and set of initial values for the endogenous variables the model allows us to calculate, recursively, the development of the endogenous variables.

Ultimate nature of system of equations is recursive (rather than simultaneous) so that each of the endogenous variables can be determined sequentially. It appear simple as well as fruitful but its application involves many problems in econometric methodology. However, it does not incorporate the idea of exogenity of the variables which has implications for causality analysis.

The plenty of empirical studies have concentrated on the examination of timing of the relationships between rates of growth of macroeconomic variables.

The usual approach followed has been to plot, the rate of growth of variables under study against time on a graph and then to observe whether turning points in one variable precede, follow or are contemporaneous with turning points in another variable. For example, one can take the growth rates of money stock and money income and then plot both variables on a graph against time just to get an insight into the direction of causality. If the cycles of nominal money lead to cycles of nominal income growth, so it can be used to justify causality from money stock to money income. However relevance of timing evidence has been seriously questioned(Tobin 1970). James Tobin has pointed out that turning points in money stock and nominal income growth rates tend to be cyclical in which case observed lead or lag would be

superficial. Quite possible that both variables money stock and money income may be affected by a third variable to which money stock react relatively rapidly. This will also render money stock leading the changes in nominal income. In their study on the relationship between money and economic activity, Milton Friedman and Anna Schwartz (1963) investigated throughly, the length and variability of the time lags, in the study on the ralationship between money and ecomomic activity. There can be no doubt according to M.Friedman and A.Schwartz, that the stock of money has displayed a systematic cyclical pattern over the decades.[45] They conducted extensive research by studying time series of money stock and business activity. By identifying cycles in these two variables, they were able to date the turning points of the series.Work by M.Friendman and Meiselmann on the influence of the monetary factor on business activity also tended to confirm M.Friedman and A.Schwartz's views. The another pioneering piece of work for studying money and money income relationship was an attempt by M.Friedman and Meiselmann (1963) to compare stability and predictive power of the money stock and autonomous expenditure in the determination of national income. Their aim was to compare Quantity Theory and Keynesian Models in 1968

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45. See Friedman and Schwartz "Money and Business cycles" Rev Econ, Statis, 45 Suppl(Feb. 1963)32.64 (b)reprinted in Friedman (1969).The lag in effect of monetary policy, J.P.E 69 (October 1961) :pp.447-66.

Anderson and Jorden published a study that highlighted the influence of various measures of fiscal and monetary policy on gross national product(GNP) and performance of fiscal and monetary policy variables was appraised on the basis of the value of impact multipliers and cumulated money multipliers and fiscal multipliers. Besides in 1970.A. Crokett[46] completed a much comprehensive work in which the lead of money over GNP was confirmed and was found to be bimodel. However there appeared to be a peak correlation when money led by one quarter and a further peak when the lead was four quarters in length. However, the size of the correlation coefficient (v=0.34)even though the data was in first difference form,suggested a large degree of slippage in the relationship.In view of the causality tests ,the attempts made by A.Crockett was just to provide some purely statistical evidences by identifying the statistical correlations between the leads and lags of pairs of economic time series. Recently new time series techniques have taken place of the more traditional methods and they have been extensively utilised to analyse the pairwise relationship, between such macroeconomic variables as money stock and nominal GNP (Sim's C.A,1972:Barth.J.R.and Bennet.J.T.1974;Ciccolo.J.H Jr 1978),or the rate of growth in the money supply (defined in several ways) and the rate of inflation (Fiege and Pearce,1976)

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46. Crockett A.L. (1970) "Timing relationship between movements of monetary and national income variables" Bank of England quarterly Bulletin 10,December pp 459-68

or the rate of growth of demand deposits and the treasury bill rate (Pierce 1977) In plenty of studies conducted in various countries, findings through new time series techniques are still in conflict with most of the previous empirical work using similar data. Hence, these findings raise questions regarding validity of the previous methodologies, the new time series techniques,or both.

However,the methodological novelty for causality test. suggested by Sims is the a direct test for the existance of unidirectional causality. Sims contended that, the test is of wide importance, since most of efficent estimation techniques for distributed lags are invalid unless causality is unidirectional,in Sims sens. More importantly Sims method is to examine the significance of future coefficients as a group through F.test. Sims has reached the conclusion that the evidence agrees quite well with a null hypothesis that causality runs entirely from Money to GNP, without feedback for the U.K.economy,Barth J.R.and Bennet J.T.(1974)[47] have found the existance of feedback between money stock and economic activity on the basis of results (by Sims method) using data for Canada, over the period from 1957 to 1972. Besides Williams,Goodhart and Cowland (1976)[48] derived an ambiguous result using U.K.

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47. Barth.JR.and Bennet.J.T.(1974) "The role of money in Canadian economy: an empirical test canadain journal of Economic May VII No.2

48. William D.Goodhart G.A.E. and Cowland.D.H.(1976)"Money Income and causality". The U.K.experience,American economic Review.66.pp 417-20

data, namely, the possiblity of unidirectional causal relationship running from income to money. To resolve these inconsistent findings, Putnam and Wilford (1978)[49] considered the role of the Pound and the Dollar in the world market. They found that U.S.A. can control its own money stock because the Dollar serves as reserve currency under fixed exchange rate regime while U.K.cannot control the money supply because the price level in U.K.is determined in the international market;and U.K.'s money supply is adjusted as, individuals in U.K. seek to maintain their equilibrium money balances. Thus, their analysis suggests that only in U.S. money can cause income but in other countries money and income are simultaneously determined. Mills and Wood (1978)[50] also found a unidirectional causal relationship running from income to money for the U.K. for the gold standard period 1870-1914 . Their finding has been consistent with Mundell's suggestions that "Monetary policy cannot affect income but rather income fluctuations produce accomodating monetary flows". Chikara Komura in his work on Japanese economy provided the evidence which indicates bidirectional causal relationship between money and both nominal and real income; a causal relationship running from money to GNP deflactor, and possible feedback from the GNP

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49. Putan,Bluford.H and Skyes Wildford "Money Income and causality in the United Stated and U.K. A theoretical explanation of different findings". American Economic Review June 1978 pp.423-27

50. Mills Terry C. and Beoffrey.E. Wood "Money income relationship and the exchange rate regime" Federal Reserve Bank of St. Louis Review, August 1978,pp 22-7

deflactor to money for the first period under the fixed exchange rate regime 1955 I to 1964 IV.Besides this, he also found a bidirectional causal relationship between money and GNP for the extended period under the fixed exchange rate regime 1955 I to 1971.II. Finally he found the period under flexible exchange rates, 1971 III - 1980 IV,indicated a unidirectional causal relationship running from GNP to money and a weak bidirectional causal relationship between money and GNP deflactor while the causal relationship running form M_2 to GNP was found to be non-neligible.

Mehara Y.P.(1978)[51] examined the causal relationship among the variables of the money demand equation,while real demand is exogenously explained by distributed lags of real income and interest rates and the results indicated no condusive relationship among nominal money demand,nominal income,interest rates and prices. As a result,he concluded that Sims findings that ,nominal money stock is stricktly exogenous in a distributed lag regressions of nominal income on nominal money stock is not inconsistant with appearance of real income and nominal interest rates as strictly exogenous in a distributed lag regression in the quarterly money demand equations,estimated in real form,In his comprehensive study,Mehara has raised specific questions for the usual single equations techniques and other relevant matters. Apart from exogenity issue, his paper raised following important questions:- (1) Is it true that the interperiod distributed lag

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51. Mehara.Y.P.(1978) "Is Money exogenous in money demand equations" Journal political Economy April p 211-4-28.

coefficients of real money on real income and nominal interest rates are not dominated by consistent pattern of infulence from real money so that real income and interest rates can really be regarded as strictly exogenous in money demand equations ? (2) Can the distributed lag coefficient on real income and interest rates be regarded as reflecting the causal patterns from real income and intrest rates to real money ? (3) Do the causal patterns observed among the real money, real income and real interest rates in a multivariate distributed lag framework of money demand equations estimated in real terms carry over if money demand equations are estimated in nominal terms?
(4) Are the causal patterns between nominal Money derived from a multivariated distributed lag formulation of money demand equation in line with causal patterns obtained from bivariate distributed lag formulation of nominal money and nominal income as reported in Sim's work ? Sims' conclusion implies that nominal money stock which is exogenous in a bivariate distributed lag framework of income on money will still be exogenous in a multivariate distributed lag framework of money demand equations.

In addition to this Fama (1975) has analysed the relationship between the monthly consumer price index. inflation rate and the nominal return on a one month treasury bill and he found that the treasury bill rate predicts the subsequently observed inflation rate.[52] Subsequently study by Nelson.C.R. and Schwert.C.W.(1977)

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52. Nelson.C.R. and Schwert C.W.(1977) "on testing Hypothesis that the Real Rate of Interest is constant".American Economic Review,67 pp 478-86.

indicates that treasury bill rate causes the rate of inflation in the Granger's sense,since treasury bill rate adds significant information beyond that contained in past inflation rates for predicting inflation. Feige and Fearce (1976)[53] re-examined. Sim's tests using different types of prefilters and found that, Sim's result do not hold up under some choices of transformation of the variables.

Are innovations in the rare of inflation independent of innovations in meausres of monetary and Fiscal/policy journal of political Economic.

In particular, when they analysed estimates of the innovations of money and income, which are residuals from univariated.ARIMA models for each of the variables, they could not reject the hypothesis that, there is no relationship between money and income at usual significance levels. Runter.J.L.(1975) analysed the relationship between the monetary base and M1 using spectral analysis and found little relationship between these time series after they have been transformed or filtered. In our study. we have utilised the causality tests using statistical techniques proposed by C.W.J. Granger(1969) and C.A.Sims(1972) to examine the causal relationship between Money stock (M_1 and M_3) and Money Income (Y) in India, and to examine the causal relationship between Money Stock (M_1 and M_3) and wholesale price Index.(WPI) in India. Same techniques are used to examine causal relation

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53. Feige and Fearce (1978),"Economically National Expectations

between High Powered Money and Money Stock.

I.5 **METHODOLOGY:** This study is based ~~no~~ on secondary data pertaining to macroeconomic variables for the Indian economy, for a period of thirty-eight years. Whenever data are not available, the analysis would be restricted to the years for which the data are avaiable. The major variables included and analysed in study are: Money supply (both M_1 and M_3); GNP, at current prices, Wholesale price Index. For this study C.W.J. Granger's and C.A.Sim's tests are utilized.

GRANGER'S METHOD : Granger has given a definition of a testable kind of causality based on the notion that absence of correlation between past values of one variable X and that part of another varible Y which cannot be predicted from Y's own past implies absence of casual influence from X to Y. In fact, Granger defined causality in terms of predictability. Thus, X is said to cause Y, if Y is predicted more accurately by including X, given other information in the model. The more operational form of this definition is as follows:

(i) σ^2 (Yt/Yt-1.....,Xt-1,Xt-2)<2 (Yt/Yt-1.....)

"X cause Y " if knowledge of past x reduces the variance of errors in forcasting Yt beyond the variance of error which would be made from knowledge of past Y alone if X causes Y and Y causes X then there is feedback between the variables. Instantaneous causality is said to occur with the current value of Yt better predicted if persent value of Xt is included in the prediction than if it is not. Realistically there cannot be an

instantaneous causality as there should be a time lag between a cause and effect. The data limitations may indicate instantaneous causality which we have to take for granted (e.g.) observed data may be monthly whereas true lag is one week. Also Pierce and Haugh (1977) proves that it is impossible to determine a unique direction of causality if instantaneous causality exists

The previous definition can be illustrated using two variable model with xt and yt, being two stationary time series with zero means.

$$(1)\quad xt = \sum_{J=1}^{m} aj \; X \; t-j + \sum_{j=1}^{m} bj \; Yt-j + Et$$

$$(2)\quad Yt = \sum_{j=1}^{m} cj \; X \; t-j + \sum_{j=1}^{m} bj \; Yt-j + nt$$

Where Et, nt are taken to be two uncorrelated white noise series, in (2) due to finite length of the data, m will be assumed finite. In (2), if some bj's are non-zero it implies Y causes x. Analogously if some cj's are none zero then x causes Y If both bj's and cj's are non-zero then there is feedback.

SIM'S Method

As stated by Sims, the test for unidirectional causality between M (money stock) and y (nominal income) is..... to regress y on past-future values of M ..... then if causality runs from M to y only , future values of M in the regression should have coefficent insignificantly different from zero , as a group. This significance of future coefficients as a group is checked through utilising the analysis of variance (ANOVA) technique. The test can be summarised as follows:

follows:

Let there by two prewhitened series y + (t) and M + (t). The following pair of equations are then estimated.

$$(1)\ Y^{*}(t) = a1 + b1\, M^{*}(t) + c1\, M^{*}(t-1) + e(t)$$

$$(2)\ Y^{*}(t) = a2 + b2\, M^{*}(t) + c2\, M^{*}(t-1) + d2\, M^{*}(t+1) + e(t)$$

$$(3)\ M^{*}(t) = a3 + b3\, Y^{*}(t) + c3\, Y^{*}(t-1) + e1(t)$$

$$(4)\ M^{*}(t) = a4 + b4\, Y^{*}(t) + c4\, Y^{*}(t-1) + d4\, Y^{*}(t+1) + e1(t)$$

The two coefficients of future vlaues of M^{*} and Y^{*} namely d2 from (2) and d4 from (4) are then tested for statistical significance using an F test with respect to equations (1) and (3) respectively. The F test is conducted under the null hypothesis that future coefficients are not satistically significant different from zero.

Direction of causality from Sims Test:

Tests of statistical significance direction of causality

1.	d2 = 0, d4 =0	Y, M are independent
2.	d2 ≠ 0, d4 =0	Y causes M (Y-M).
3.	d2 = 0, d4 ≠0	M causes Y (M-Y)
4.	d2 ≠ 0, d4 ≠0	Feedback between M and Y M-Y

It is possible that F tests may field inconclusive results. In such cases and even regardless of of the value of F statistic , Sims recommends that the absolute size of regression coefficients could be helpful in detecting direction of causality. Thus , if in equation (2) d2 eventhough statistically insignificant, is large or if d2 c2 and in (4) d4, eventhough statistically significant is small or less than c4 , causality from Y to M may be very important in practice.

1.6. THE OBJECTIVES OF THE STUDY :

The objectives of tho study are:

(1) To study and an analyse the macroeconomic relatioships in India.

(2) To test empirically the causality between money supply and money income in India.

(3) To test empirically the causality between money supply and prices in India.

(4) To test empirically the causality between high-powered money and money supply in India.

(5) To analyse effectivness of Monetary and Fiscal policies in India in light of the empirical results derived .

(6) To evaluate exogenity and endogenity of money supply in India,

1.7 SOURCE OF DATA :

This study is based on secondary data pertaining to macroeconomic variables for the Indian economy for a period of thirty eight years (1950-51 upto 1987-88). Whereever data are not available ,the analysis would be restricted to the years for which data are available.The major variables included and analysed in study are Money supply both M1 and M3 . (M1 = currency with public + other deposits + banks saving deposits on which no interest was paid and M3 =M1+time deposits with banks) GNP at current prices Wholesale Price Index, High-Powered Money. Data related with above mentioned macroeconomic variables are collected from various issues of Reserve Bank of India Bulletin (RBI) , issues of Economic Survey Government of India, Report on Currency and Finance and Data Base - Indian Economy by Pranoy Roy and Chondhok 1989-90. The Indian Economic Journal etc.The data

related to all variables as on last Friday Here, it is to be noted that available data and aspecially in the absence of the consistent quarterly data, the use of some sophisticated time series techniques has been circumscribed, even for comparison purpose of empirical results.

Following Sims, all variables used are measured as natural logs and we have used first difference of the variables [viz $\overset{*}{x}(t)-x(t-1)$] to transform each of variables. The filter approximately flattens the spectral density of most economic time series and the hope was that regression residuals would be very nearly whitenoise. With the prefiltering (Sims,1972). "A whitenoise" is a serially uncorrelated process. Besides, by using logarithmic and differencing transformation of the raw data.The variables are presumed to exhibit the properties of stationarity,that is,constant unconditional mean and variance over the sample period.

1.8 **CHAPTER SCHEME** :

The study is divided into the five chapters.

Chapter I is introductory. It gives background, purpose, the plan of the study , methodology , nature of data its sources, idea and rationale of study and chapterisation scheme.

Chapter II deals with "Money and Income" theoretical survey and empirical test of causality between money supply and money income in India.

Chaprer III relates to the "Money and prices", theoretical survey and empirical test of causality between them, related to India.

Chapter IV include survey related with "Money supply" theories and empirical test of causality between high-powered

money and money supply in India.

Chapter V contain summary of the study and major conclusions of the study.

I.9 Symboles and abbreviations used in this study.

(1) M_1 OR M1 - currency with Public + other deposits + banks saving deposits on which no interest was paid.(measurued in Rs. Crore)

(2) M_3 OR M3 - Money Supply = M_1 + Time Deposits with Banks (In Rs Crore)

(3) t - particular year.

(4) Y - GNP = Gross National Product At Factor cost at current prices: in Rs crores

(5) WPI - Wholesale Price Index All commodities (Base 1970-71) Weight : 100.000

(6) HM - High Powered Money= currency with Public + other depostis with RBI + Cash with Banks + Bankers deposits with RBI Total (In Rs Crores)

(7) GDF - Government Deficit Financing, States + Center (In As crores)

(8) AER - American Economic Review

(9) EPW - Economic and Political Weekl;y

(10) FR - Federal Reserve

(11) HMSO - Her Majesty's Stationary office

(12) ICSSR - Indian Council for Social and Scientific Research

(13) IEJ - Indian Economic Journal

(14) JEP - Journal of Political Economy

(15) NBER - National Bureau of Economic Research,

(16) QJE - Quarterly Journal of Economics,

(17) RBI - Reserve Bank of India.

(18) QTM - Quantity Theory of Money,