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# Price, Loanable Fund and Indifference Curves: Theorizing Authority through Misuse of Mathematics, Logic and Improbable Assumptions

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## Abstract

Theories, Price, Loanable Fund and Indifference Curves taught and studied today in universities is purely an attempt to glorify the subject through misuse and ornamental use of mathematics and logic. In Price theory with some arbitrary data (quantity X, and price Y) two lines, one with positive slope and another with negative slope are drawn in the first quadrant. In the development of the theory, important factors (tastes, incomes, prices of other goods, new substitutes, availability, obsolescence etc) are totally ignored. Utility is another function which is purely a mental concept. For Indifference Curves(ICs) assumptions are i) ICs slope downwards to the right ii) ICs are concave to the origin iii) ICs can not intersect each other iv) ICs can not meet or even touch each other. In spite of these assumptions, geometrically and physically, the measure is supposed to be ORDINAL. At no stage any mathematical equations are given. In Loanable fund theory X is Loanable Fund and Y is Rate of Interest. Interest has been defined/ described /explained by many economists in different ways. Loanable Fund theory explains the rate of interest through the equilibrium between demand for and supply of Loanable Fund. Demand Curves (Dis- savings, Investment and Hoarding) and Supply Curves (Savings, Disinvestment, Dishoarding and Bank Money) represent these seven components only by straight lines. All these assumptions do not pass mathematical rigor and practical situations. Many important factors like time, duration, risk, productivity, taxation, market standing etc are totally ignored. This Paper shows the anomalies seen but does not give any solution. These topics should become history and do not deserve a place in current Economics.

**Keywords:** Economics, Indifference curves, Loanable fund, Price theory, University education

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## **1. Introduction**

This paper discusses three theories in Economics that are, so called, considered foundations of modern economics and goes on to show how no considerations are given to the cause and effect relationship of various parameters that need to be considered in the development of these theories. But first, let's start with the historical background of definitions in Economics in general.

Economist Adam Smith's study ( 1776 ) initially was 'Political Economy' , then, knowledge used for eradicating poverty, want, unemployment and then to study inflation, stagnation, recession etc.. Thus it became the science of economics.

Economist J.M.Keynes viewed ' Political Economy' and added three definitions a) Wealth b) Welfare and c) Scarcity in the study .

Richardo shifted from production and distribution of wealth to “ The produce of earth - all that is derived from its surface by the united application of labour , machinery and capital .

Economist T.R. Malthus (1820) joined to add one more dimension of wealth “material(productive ) wealth and immaterial (unproductive) wealth”.

L. Robbins and others criticised the neglect of immaterial wealth and stressed the importance of services. Modern economists are of the view that the immaterial wealth - services are essential to increase production, productivity and good health.

Economist Alfred Marshall stated “ Political Economy or Economics is the study of mankind in the ordinary business of life ; it examines that part of individual and social action which is most closely connected with the attainment and the use of the material requisites of well-being”.

Robins (1931), defined economics based on i) Unlimited wants ii) Scarce means and iii) Alternative uses of means .

This is the historical background of definitions in Economics in general. With utopian and illogical assumptions, passing no mathematical rigor, ignoring very vital parameters and free use of mathematical figures as ornaments the topics of a) price theory b) loanable fund theory and c) indifference curves have no theories, no precision but are only verbose and literary in nature. The domains of, price, cost, production, consumption, output, utility, resources, manpower, subsidies by governments, bank loans, etc. are affected by time, new technologies, automation, new laws, consumers' tastes, purchasing power, obsolescence, creation of non degradable waste, shelf life of the produce, storage capacity, artificial intelligence, etc. But in the development of these theories no considerations are given to the cause and effect relationship. Everything happens only in the first quadrant of X and Y axes.

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One may pick up any book right from undergraduate level to post graduate level and further, on price theory, authored by any renowned Economist, the researcher would find all figures and discussions confined only to the first quadrant of X axis and Y axis. The trigonometric words, tangent, angle, slope (-ve or +ve), are not used but the suitable curves are described as sloping downwards/ upwards from left to right.

This price theory with no substance in it dominated the academic world in the 19th and the 20th centuries. Now in the 21st century the so-called “Price Theory” should be replaced by some useful subject in college and university syllabi.

## **2. Price theory**

In Economics, the theory of price hangs on many assumptions and the single weak thread of assumed 'Demand Curve'. Some data of price - wheat / price - apples, etc. are taken so as to suit the straight line drawn beforehand. In most of the books thus is the demand curve defined.

- A. To make it more mathematical, within the next few lines it takes the shape of a curve (with negative slope ,convex to the origin, sloping downwards from left to right) which facilitates the researcher's predetermined inferences.
- B. Demand curve assumptions regarding price,quantity,taste,time,market conditions etc are not realistic, thus are ignored in development of theory, but they are taken because of the advantage of simplicity, convenience and being ornamental in nature .Without any use of trigonometry, sine , cosine , tangent etc the demand, price , supply curves are described . Here the student is taken for a joy ride.
- C. All the operations are supposed to be only in the first quadrant of X and Y axes. This only shows by itself that although the theory deals with individuals, markets, market conditions, time, choices of the consumer, availability of product , lifespan of the product, obsolescence of the product, new inventions in the market, substitutes for a product, purchasing power of the consumer, rural/urban areas, famine / drought conditions, floods, excess production etc. still the variables can not have negative values. The curves drawn are smooth sloping downwards or upwards from left to right and essentially intersecting in the first quadrant only.
- D. The curves and the straight lines are pure decorations with no mathematics or no other justifications.
- E. How this theory with no scientific approach and mathematical violations has survived for such a long time is a mystery .

For price theory this author has taken a new approach , a non mathematical one , to enable the non mathematical academicians ( in fact economists ) to be part of the discussion . When

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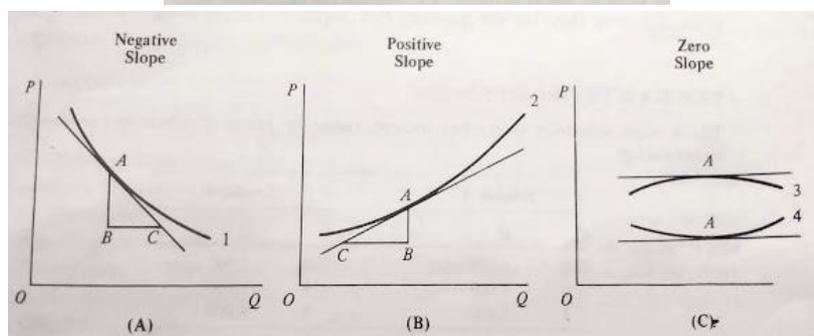
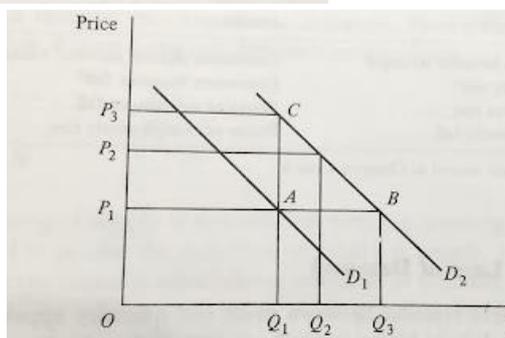
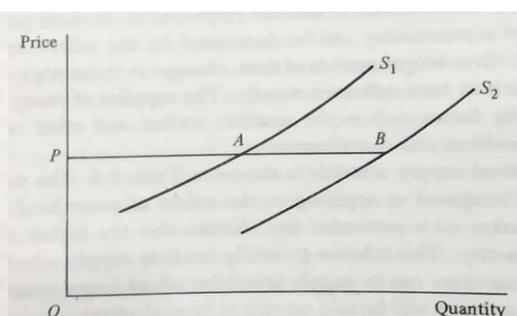
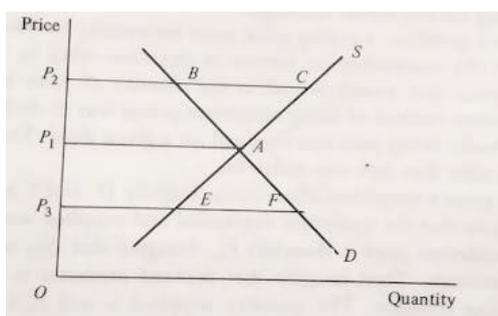
discussed, corresponded with many economists, who were teaching the subject to degree students for many years or were heading research organizations in Economics, the answer was ‘knowledge of Mathematics is not necessary’. This of course is my experience when the topics were discussed with the concerned individuals.

Below are some diagrams one would find in the introduction of price theory, they don’t show any data or numbers.

The diagrams are from some books given under reference. There is no intention of underestimating the competence of the concerned authors.

(a) Equilibrium of Demand and Supply

(b) Change in Supply



(c) Change in Demand

(d) Slopes shown thus.

This is how the subject is being introduced in most of the books.

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To draw parallels to anomalies in price theory, this author would like to cite three historical facts about the so called western advanced nations's attitude towards other nations

1. A German cartographer , way back in 1596 drew a map of the world for the benefit of sailors . He had horn shaped Africa , boot shaped Italy and other land masses but sizes were wrong . North America was made to look as big as Africa , the Scandinavian countries bigger than India, China smaller than Greenland . In reality India is three times bigger than Scandinavian countries put together, China is four times larger than Greenland and one could put three North Americas into Africa . Why did this happen ? . Gerardus Mercator , the map maker was German and while deciding the centre of his projection of the earth , he arbitrarily chose his country , Germany. As a result the equator was placed not half way down as it should be but two thirds of the way down and sizes were distorted in favour of the wealthier lands of the north. Mercator opted not to travel but acquired knowledge from books, travellers, merchants, statesmen instead. Had he ventured out more, his work would have been a more accurate reflection of the fact. It was a national pride for the German. This map continued for the next 300 years or so in school education .
2. After the second world war, Germans and Japanese war criminals were tried at the international level. Crime was the killing of troops of Allied forces during the war. Trials were held at Nuremberg, Tokyo, Tehran, Yalta etc. The US, UK , USSR and France were the members of the committee formed for the purpose. 50 million lives of Europeans were lost as per record . Thousands of Nazi Germans and Japanese were tried and sentenced to death by hanging . These trials were held without any Law. Whatever law was observed for these sentences but the same law was not applied to the US for killing lakhs of innocent Japanese by dropping atom bombs on Hiroshima and Nagasaki.

Here the point to be stressed is once the westerners or wealthier nations decide to accept a certain hypothesis they would convert it into law or theory and force other nations to follow the same.

3. Nicolaus Copernicus (1473 -1543), Polish, an astronomer, researched that earth and other planets revolve around the sun. It took nearly 100 years ( Galileo, 1632 ) for the scientific community to accept Copernicus' theory . Even genuine research took 100 years to get it accepted by the scientific community .

Here are a few more examples to show futility in the assumptions in price theory.

- A. If the assumptions made and important parameters ignored in price theory were true then scientific progress would have come to a stop. Arms research and progress as

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seen, sword, guns, machine guns, tanks, artillery, rockets, missiles, space programs would not have happened . Just imagine demand, supply, utility, price assumptions made in the theory and visualise the world without progress.

- B. If the market was as smooth as assumed in price theory, then in the world over, so many banks, air travel companies, pharmaceutical companies would not have gone bankrupt .
- C. The communication methods, cycle, tricycle, four wheelers, aeroplanes, ships, space travel would not have seen the light of the day if the assumptions made in the theory were true .
- D. Writing methods, pens, ball pens, keyboards, computer languages, laptops, sms, whatsapp, etc., modernization would not have happened if the assumptions in the price theory were reality .

In the absence of any mathematics and logic and presence of unrealistic assumptions this price theory has not contributed to the advancement of economics. The economists have been successful in pouring this untenable theory down the throat of academicians for more than 100 years .

Thus the author of this paper doubts the very existence and utility of price theory in the near and distant future .

In order to avoid repetition this author would deal with loanable fund theory and indifference curves in details in this later part of this paper.

### 3. Indifference Curves (ICs) and underlying assumptions

First, we consider some definitions/descriptions/assumptions made by various authors in their books. In almost all the books, data to suit the curve or the curve to suit the convenience is drawn first and then assumed properties are shown as observed by the curve. To suit further assumptions, ICs are drawn so that they do not touch or intersect and have negative slopes. ICs have come through the research of Edgeworth (1881), I.Fisher (1892), Pareto (1906), Slutsky (1919), Hicks and Allan (1934) and Hicks (1939).

The theory and the concept are being studied and taught for the last 120 years or so. The researchers found the cardinal measure 'Marshallian Utility Measure' unsatisfactory and unconvincing. Two economists Hicks and Allan developed the concept of ' Indifference Curves' and considered it to be an *Ordinal Measure*. The concept has three assumptions

- i) Non Satiety ii) Transitivity and iii) Diminishing Marginal Rate of Substitution.

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For the purpose of this paper these assumptions are accepted. Further for the ICs, the governing properties are:

1. ICs slope downwards to the right
2. ICs are convex to the origin
3. ICs can not intersect each other
4. ICs can not even meet or touch or be tangent to each other.

These governing properties are themselves all assumptions. No mathematical explanation is provided to support the same. In spite of the above assumptions geometrically and physically the measure is supposed to be 'ORDINAL' i.e. No quantification and only qualitative measure of grading or rating is possible.

At no stage in the development and the use of ICs, is any mathematical equation used to represent the ICs. Only  $f(x,y)$  or some similar notations are used. This paper deals with the intricacies and contrasts developed in the situation. If two or more ICs are to observe the above conditions, notional, geometrical and mathematical, then what are they actually?

Let us see what different authors have to say in the matter.

- ' IC shows various combinations of commodity X and commodity Y that yields equal utility or satisfaction to the consumer <sup>21</sup>
- Curve is shown (Jeans against CDs) with a comment that preference must be a) rational b) consistent and c) complete to define ICs<sup>5</sup>
- No data .Only two smooth curves are drawn (Gas against electricity units) to define ICs.The author further states that the practical problems of constructing such curves are virtually insurmountable but this does not detract us from their theoretical explanation. Accept that i) Individual ICs do exist ii) they can be meaningfully combined to yield community ICs and iii) they are convex to the origin. The curve is generally postulated as convex to the origin and the slope is declining.<sup>16</sup>
- IC is the locus of points involving combinations of rates of combinations of the two products or sets of products X and Y with all points on the curve yielding the same level of satisfaction. It is ordinal in character, only preference is asked from the consumer. Examples are bread and wine. Curve is drawn first and then inferences are drawn<sup>15</sup>
- Diagram is drawn directly . Think of the consumer as sliding up and down the IC. Then he is equally well off at any point on the IC. Commodities in question are divisible into very small units. There is convenience in drawing a smooth curve. Preference means moving North-East on the map IC. Maps are drawn so that curves appear to be parallel to one another. Parallelism is devoid of economic significance.<sup>26</sup>

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- Economists do not believe that utility has a cardinal measure. Only ordinal measure is considered, i.e. 'much or less' and not 'how much'. Consumer behavior in terms of preferences which in turn are defined only by behavior. The results are circular. Hypothesis places definite restrictions.<sup>21</sup>
- Shape of the IC is predetermined. It is either steep or shallow. ICs are convex to the origin.<sup>23</sup>
- ICs are negatively sloped. It shows a diminishing rate of substitution. The measure is ordinal.<sup>22</sup>
- Utility is ordinal. Indifference maps may have  $au+b$ ,  $a\log x$ ,  $au.u$ . Indifference map is a system of curves  $u(x_1, x_2) = \text{constant}$ .  $I_1, I_2, I_3 \dots$  system of curves are drawn in the  $Ox_1x_2$  as indifference map.<sup>2</sup>
- With no factual data ICs are drawn, first a three dimensional diagram and then a two dimensional diagram. An inference is drawn that if two points are on the same IC they have the same utility. A comment is made that 'we have come to a remarkable thing about ICs..... with wide economic significance.....given wants.....scale of preference <sup>8</sup>...

It can be seen that most of the authors have presumed the existence of the ICs in the shape of a curve

- i. convex to the origin,
- ii. with negative slope,
- iii. not intersecting with each other
- iv. not tangent to each other and
- v. having an ordinal measure.

The author of this paper sees some of the possibilities. The diagrams are in the XY plane and restricted to the first quadrant. Only in the cases of hyperbola all the four quadrants are shown. This is only to show that the dichotomy that creeps in if the curves are to observe the above imposed conditions. None of the definitions/ descriptions / assumptions of ICs by different authors of various books referred to have given any significance to its presumed ordinal characteristic.

I ) In figure No.1 the ICs are parallel to each other within the limits of goods X and Y

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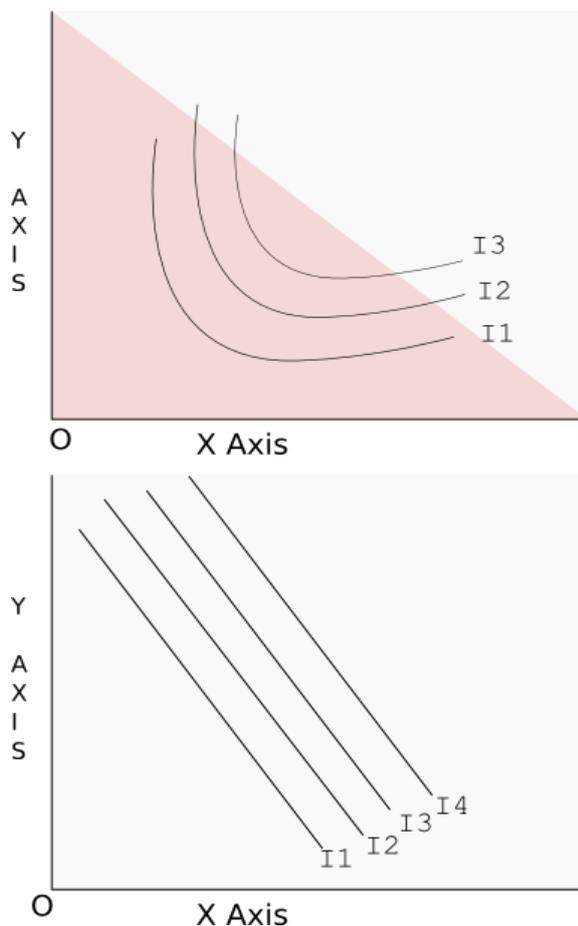


Figure 1: System of Straight Lines Figure 2 :System of parabolas

II) In fig.2 a system of parabolas, one inside the other, is shown. Each curve represents one IC and at any point on one curve, the same amount of satisfaction is derived by the consumer. The IC above it gives a locus of points giving equal amount of satisfaction but more than the satisfaction on the curve below.

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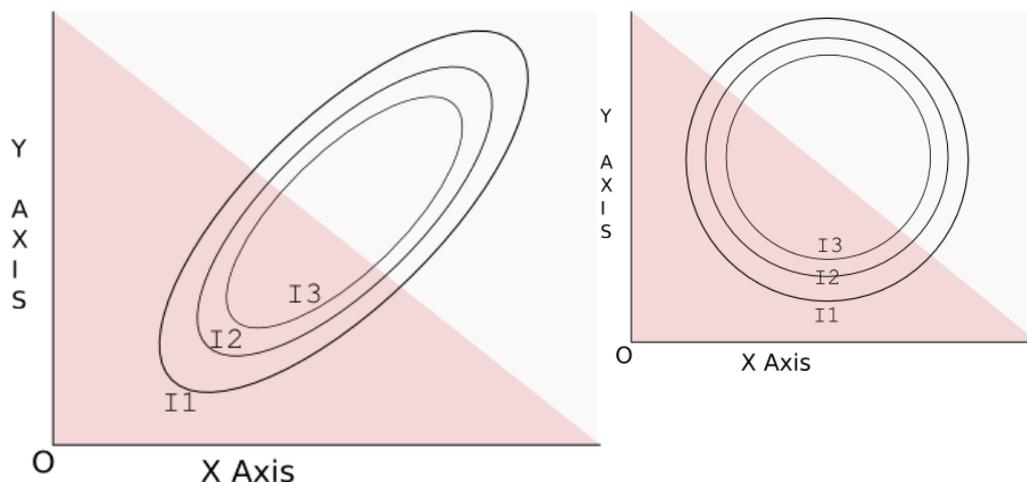


Figure 3: System of Circles Figure 4 :System of ellipses

III) In fig 3 ICs are a system of concentric circles till the time the curve of the circle is convex to the origin.

IV. Similarly fig. 4 shows a system of ellipses one inside the other till the curves are convex to the origin.

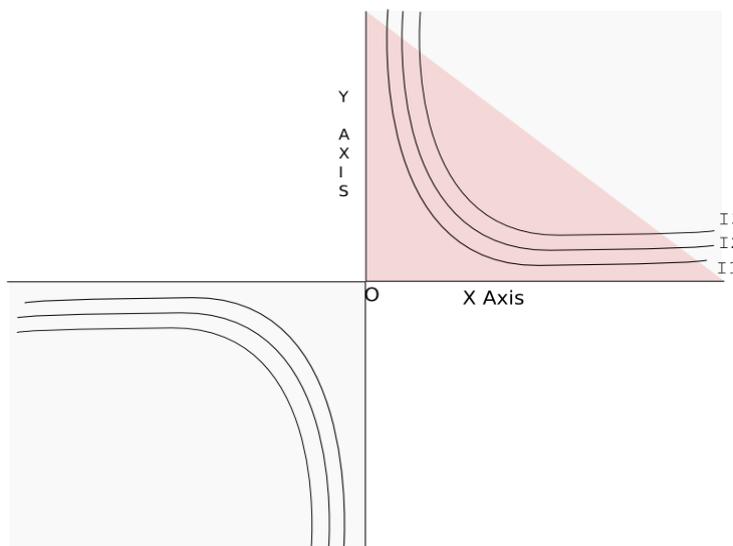


Figure 5: System of Hyperbolas

V. Fig 5 shows a system of hyperbolas restricted to the first quadrant and also that the curves are convex to the origin.

VI. ICs have to be symmetrical about a point . If this property is not observed by the ICs they are likely to intersect each other at some point or the other.

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VII. Why almost all the books or papers do not give any mathematical equation(s) to represent the ICs.

VIII. The level /grade/ranking of consumer's satisfaction ,is it a discrete or a continuous variable. By very nature of assumptions it has to be 'Ordinal '

IX. Even though the commodities along the X axis and the Y axis seem to be discrete and the points on the IC ( Amount of Satisfaction) are ordinal . In further analysis use of differentiation, partial differentiation is made and inferences drawn. When there is no continuous variable on the two axes,how far this use of mathematics is justified?

X. Arbitrary and suitable curves are drawn to show and justify substitution and price effects.

XI. Do ICs really support ordinal measurability?

There are ambiguities and inconsistencies in the argument and assumptions in the development of the theory of ICs.

Further once the tool of ICs is ready what purpose does it serve? With so many constraints and no such market prevailing anywhere it has become a futile theoretical exercise based on non tenable conditions. So many mathematical curves spread over the development of ICs but there is not a single mathematical equation to justify the nature of the curve. Without accounting for the nature of the variable ,discrete or continuous , the tools of differentiation and partial differentiation are used freely. This shows no accountability for such uses.

It was Galileo who realized the importance of measurement and wrote,

*Count what is countable,*

*Measure what is measurable ,*

*And what is not measurable ,*

*Make it measurable.*

If the consumer is able to give his preference to particular combination of two goods ( generally discrete in nature ) by grade or rank only while observing all other conditions, mathematical and some assumed, the preference can not possibly be 'ORDINAL' Further he is also able to distinguish his level of satisfaction even because of very small changes in either of the goods. There is no such possibility.

The author feels that the very foundation of 'indifference curves' that the measure is 'ordinal' becomes doubtful and not tenable. Why insist on a loose foundation and build a big mansion on it? No purpose is being served by the existence of ICs in the present form. One can do away with it.

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#### 4. Loanable fund theory

##### (An Extension of 'Interest' In Price Theory)

Any assumptions made while initiating the theory and further developing it need to have sound reasoning, need to stand simple practical situations and mathematical tests. Loanable fund theory is a glaring example of a theory which defies logic and mathematics. The author, in this paper, cites examples of anomalies and aberrations in the present scenario of the 'Loanable Fund Theory'.

In price theory in economics there is a branch of 'Interest'. Interest has been defined/described /explained by many economists in different ways. Loanable fund theory explains the rate of interest through the equilibrium between demand for and supply of loanable funds.

Demand Curves      Supply Curves

DS - Dis-savings      S- Savings

I – Investment      DI– Disinvestment

H – Hoarding      DH – Dis-hoarding

BM – Bank Money

$DL = DS + I + H$        $SL = S + DI + DH + BM$

Almost all the books covering the topic of loanable fund theory represent these seven components by straight lines. The three under demand are to be parallel to each other with negative slopes and four components under supply are parallel to each other with positive slopes. Further the three lines are added, and one gets the summation curve, again a straight line (DL). Similarly, four lines in the other set are added and one gets a summation curve, again a straight line (SL). Another assumption is that these two DL and SL must intersect and that too in the first quadrant.

Consider how many assumptions are made which are not feasible in practice and are also non-mathematical.

1. All the seven parameters, in demand and supply together, which are represented by straight lines are not so in practice, barring a few situations. Many important factors (time, duration, risk, productivity, taxation, market standing etc.) are ignored just to get the parameter to follow a straight line.
2. Even if supposedly they are represented by straight lines, then why should they be parallel to each other than to suit the convenience of the theory but with no accountability for the parallel lines.

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3. The summation lines of demand and supply must intersect in the first quadrant. This is because the point of equilibrium, geometrically, must come in the first quadrant to suit the assumptions.
4. Summations must be straight lines.

This is a chain of incorrect assumptions, illogical inferences, and free use of geometrical figures to suit the development of theory and there are no mathematical equations. Then why teach this theory and enhance an untenable and unproven way of thinking in the minds of students of Economics?

## **5. Conclusion**

This paper shows the anomalies seen. These topics should go away from syllabi and become history. They do not deserve a place in current Economics.

## **References**

1. Ahuja H.L. 'Principles of Microeconomics', S.Chand and Co. New Delhi,India,1998
2. Allan R.G.D., 'Mathematical Economics' Macmillan Ltd ,New York, 957
3. Boulding K.E. , 'Economic Analysis ' , Vol .I and II,Harper and Row, 1941
4. Bowden E.V., ' Economics the Science of Common Sense ' , Federal Pub, 1977
5. Cook Mark and Covvi Farquharson,' Business Economics', Pitman Pub,1998
6. David De Meza and Osborne, ' Problems in Price Theory '
7. Hirshleifer Jack and Amihai Glazer , ' Price Theory and Applications' ,
8. Hicks J.R. , ' Value and Capital ' , Oxford Uni Press,1939
9. Hicks J.R., 'The Theory of Economic History', Oxford Uni Press, 1969
10. Hicks J.R. , 'The Social Framework,An Introduction to Economics' Oxford, 1952
11. Hicks J.R., 'A Market Theory of Money' ,Clarendon Press, 1989
12. Hicks J.R. , 'A Revision of Demand Theory' , Oxford Press,
13. Jhingan M.L., 'Microeconomic Theory' , Vrinda Pub, New Delhi,2002
14. Landsbung Steven E. , 'Price Theory and Applications', The Dryden Press, 1989
15. Lester O Bumas ' Intermediate Microeconomics' Prentice Hall , India , 1993
16. McCloskey Donald N., 'The Applied Theory of Price', Macmillan Pub, 1982

**13<sup>th</sup> International Conference on Modern Research in  
MANAGEMENT, ECONOMICS and ACCOUNTING**



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17. Oak A D , Misuse of mathematics ....., Hawaii International Conference on Social Sciences , 30 May 2007 , Honolulu
18. Oak A D , ' Unless existence of Indifference curves is proved ... , International Conference on Comparative Development , 18-19 Dec, 2007 , New Delhi
19. Oak A.D. Paper on 'Indifference Curves ' at 3rd Statistics International Conference ,Nov16-18,2006 ,Bucharest,Romania, ( Paper abstract accepted)
20. Oak A.D., Paper' Loanable Fund Theory' to be read at 34th Meeting of Academy of Economics and Finance,Jacksonville,Florida, Feb,16-17,2007 ( Paper abstract)
21. Oak, A. D Paper on 'indifference curves in price theory' 18-20 Dec, 2006, All China Economics International Conference, Hong Kong, China
22. Oak A D , ' Price , Loanable Fund and indifference curves .....,International Conference on Advances and Applications in Mathematics .....,1-2 Nov ,2019 , Andhra Loyola , India
23. Oak A D , ' Loanable fund theory .....,International Journal of Mathematical Sciences and Engineering Applications ,ISSN 0973-9424 , vol 3, No.1 , 2009 pp 75 to 97
24. Price Catherine M , 'Welfare Economics in Theory and Practice',Macmillan,1977
25. Ray N.C. , ' An Introduction to Microeconomics' , Macmillan,New Delhi, 1975
26. Reekie and Crook, 'Managerial Economics' ,Heritage Publications, 1983
27. Salvatore Dominick, ' Managerial Economics ' McGraw Hill, 1989
28. Samuelson P.A. , ' Foundation of Economic Analysis', Harvard Uni Press, NY,1965
29. Seth M.L., ' Principles of Economics', Agarwal Publications, Agra,India
30. Speight H. , ' Economics, the Science of Prices and Incomes ' Methuen, London,1964
31. Watson Donald S, and Getz, 'Price Theory and its Uses', Scientific Books,Kolkata,1967
32. Webster's Student Dictionary,Trident Press International, Ed 1996