FULL PAPER





Cordial labelling of molecular structures and labelled topological indices of molecular graphs; a qspr model

Vinutha S.V.^a | Shrikanth A.S.^{b,*} | Nagalakshmi A.R.^c

^aDepartment of Mathematics, K.S. School of Engineering and Management (Affiliated to Visvesvaraya Technological University), Bengaluru-560109, India

^bDepartment of Mathematics, Adichunchanagiri Institute of Technology (Affiliated to Visvesvaraya Technological University), Chikamagalur-577102, India

^cDepartment of Mathematics, Malnad College of Engineering (Affiliated to Visvesvaraya Technological University), Hassan-573201, India

*Corresponding Author:

Shrikanth A.S. Email: shrikanthas@gmail.com Tel.: +9964359008

the ideas of topological indices with graph labelling, resulting in a number of novel topological indices to study the labelled graphs. We present new topological indices for certain molecular graphs that admit cordial labelling in this article. Through topological indices, graph theory is playing an essential part in QSPR data analysis. In this paper, we consider the labelled square index SQI(G), labelled product Index PI(G), labelled sum Index SI(G), labelled Nirmala Index NI(G), labelled Sombor Index SOLI(G), labelled forgotten Index FI(G) and Cluster of all these Indices.

In the study of graph properties, topological indices and graph

labelling are both enormous topics. In this paper, we connect

KEYWORDS

Introduction

Chemical graph theory is a branch of mathematics concerned with chemistry that blends mathematical design and graph theory to study chemical processes. It focuses on topological indices which have been closely connected with chemical molecules and molecular characteristics. Topological indices are frequently utilized in the structure-activity relationship/ quantitative structure-property (QSAR/ QSPR) design to predict the characteristics of a molecule or molecules.

Let G(V,E) be a simple connected graph with V(G) as the vertex set and E as the edge set E(G). A molecular graph is a figure that used to represent synthesized good in addition to express the drug's chemical structure. We refer to [1] for any additional concepts or terms.

A molecular descriptor emphasizes in providing the most accurate numerical

Chemical graph; molecular descriptor; labelled topological indices; cordial labeling; regression models; QSPR.

representation of potential molecule form. The most commonly used molecular descriptors are molecular connectivity indices. These molecular meters are often referred to it as topological indices because it describes the topology of a molecule. They are considered like graph invariants since their concepts are based on notions from graph theory. In theoretical chemistry, their specific features have been studied and have found with considerable form particularly in QSPR/QSAR/QSTR research [2-12].

molecular graph depicts Α the of unsaturated hydrocarbon skeletons molecules and their compounds. Its edges indicate covalent links between nonhydrogen atoms, while its vertices represent non-hydrogen atoms. Molecular graphs have important functions in chemoinformatics [13], quantitative structure-property relationships(QSPR), quantitative structureactivity relationships (QSAR), virtual

screening of chemical libraries and computational drug design.

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Drugs are often considered as a critical tool for preventing and controlling diseases. Drug development is a time-consuming, difficult and costly procedure. In the field of drug development, computer-aided drug design plays an essential role. This involves predicting target candidates' electronic, drug-like pharmacokinetic, 3D-QSAR and physicochemical characteristics.

Molecular structures of some drugs

Chloroquine is the most widely used medication to treat malaria. It is also used to treat autoimmune illnesses. Chloroquine inhibits DNA replication and RNA transcription by interfering with nuclear proteins .It is an antimalarial drug that is taken orally [14,15], has more information.

Hydroxychloroquine possesses antiviral properties which are quite similar to chloroquine. Both have immune modifying properties that can boost their antiviral efficacy in vivo. These drugs dampen the cytokine storm by blocking T cell activation, which reduces COVID-19's acute evolution. See [15,16] for more information and it was Hydroxychloroquine is made from 4-aminoquinoline. Since World War II, it has been utilized as an antimalarial medication. It is also used to treat skin problems, lupus erythematosus, rheumatoid arthritis, and other inflammatory conditions.

Remdesivir is an antiviral medication that is being tested to prevent Ebola virus infection. In addition, it is a medication that can fight a variety of viruses. Remdesivir is a nucleotide analogue medication which prevents the replication of viral RNA. It is being studied as a COVID-19 treatment and has been approved for emergency use in the United States, India, and Singapore, as well as for patients with severe symptoms in Japan, the European Union, the United Kingdom, and Australia. The clinical trial is now taking place at many hospitals, and efficacy testing is pending. See [17,18,19, and 20] for further information.

Ribavirin is an antiviral drug that treats hepatitis C, RSV, and certain viral hemorrhagic fevers. It is used in the treatment of hepatitis C alongside other drugs like simeprevir, peginterferon alfa-2b, sofosbuvir and peginterferon Alfa 2a. For Ebola or Marburg infections, it should not be used. Ribavirin can be breathed or given by mouth. Ribavirin was first used in 1986 after being invented in 1971. For more details, See [21,22]

Favipiravir is an anti-RNA virus pyrazine carboxamide derivative. Favipiravir works by inhibiting an enzyme called RNAdependent RNA polymerase, which is involved in viral genome reproduction and replication. Toyama Chemical Co., Ltd created this medicine for the treatment of influenza A and B in Japan and it is only approved for use there. Furthermore, it is being experimented for the therapy of COVID-19 and viral hemorrhagic fever (Ebola). For more details, one can refer to [23,24,25].

Thalidomide is used to treat psoriasis systemic lupus erythematosus and gastrointestinal inflammatory illnesses, among other autoimmune conditions and it causes congenital abnormalities (phocomelia) in the fetus [26].

2-phenoxyethanol is the aromatic ether with a 2-hydroxyethyl group substituting on oxygen. It works as an anti-infective and a depressant for the central nervous system. It's glycol ether, an aromatic ether, and a primary alcohol. It is mainly composed of phenol.

Chloroquine, Hydroxychloroquine, Remdesivir, Lopinavir, Ritonavir, Arbidol, Theaflavin, and Thalidomide are all possible COVID-19 treatments [27]. To forecast boiling point, molar refractivity, surface tension, polarizability, polar surface area and molar volume of these medicines, the



most relevant topological indices and curvilinear regression studies are achieved.

Alsinai *et al.* [28] introduced Hdr degree based indices and mhr-polynomial for the treatment of covid-19. Ammar Alsinai *et al.* [29] introduced Reciprocal leap indices of some wheel related graphs. Arkhanda Afzal *et al.* [30] introduced topological aspects of silicate network using M-polynomial. Alsinai *et al.* [31] worked on fourth leap Zagreb index of graphs. Hasan *et al.* [32] introduced distance and Degree based Topological Polynomial and Indices of X-Level Wheel Graph.

G. Princess Rathinabai *et al.* [33] introduced and defined the density-based topological indices. Motivated by this paper, we are extending this concept to labelled based topological indices for the above molecular structures.

Definition 1.1 [33]: Labelled Incident of vertex, $L_I(u)$, with regard to a labeling of a labelled graph *G*, is defined as $L_I(u)$ = $\sum f(uv)$ where f(uv) is the label allocated to the edge *uv*. In other words, labelled Incident

of vertex *u* is the sum of all the labels of the edges that intersect with u.

Definition 1.2 [34]: A labelled graph is a graph with labels applied to its vertices and edges based on some particular concept. We construct some distinct types of new topological indices in this part and introduce the concept of a vertex incident in a labelled graph. Only non-negative integers are used as labels in the introduction of new topological indices.

Definition 1.3 [35]. Let f be such that f: V (G) \rightarrow {0, 1} and for each edge uv assign the label |f(u) - f(v)|. A binary vertex labeling of a graph G is called cordial labeling if $|v_f(0) - v_f(1)| \le 1$ and $|e_f(0) - e_f(1)| \le 1$, where $v_f(i) \& e_f(i)$ denote the number of vertices and edges of G with label i(= 0 or 1), respectively. If it admits cordial labeling then graph G is cordial.

The followings (Table 1) are the notations used in the subsequent section: For more details follow [36,37,38,39,40,41,42,43,44].

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Topological indices	Formulae
Labelled Incident of vertex	$L_I(\mathbf{u}) = \sum f(uv)$
Labelled Square Index of (G)	$SQI(G) = \sum L_I(u)^2$
Labelled Product Index of (G)	$PI(G) = \sum (L_I(u)L_I(v))$
Labelled Sum Index of (G)	$SI(G) = \sum (L_I(u) + L_I(v))$
Labelled Nirmala Index of (G)	$NLI(G) = \sum \sqrt{\left(L_I(u) + L_I(v)\right)}$
Labelled Sombar Index of (G)	$SOLI(G) = \sum \sqrt{L_I(u)^2 + L_I(v)^2}$
Labelled Forgotten Index of (G)	$FI(G) = \sum L_I(u)^2 + L_I(v)^2$
Labelled Cluster Square Index of (G)	$CSQI(G) = \frac{SQI(G)}{\sum L_I(u)}$
Labelled Cluster Product Index of (G)	$CPI(G) = \frac{PI(G)}{\sum L_1(u)}$
Labelled Cluster Sum Index of (G)	$CSI(G) = \frac{\overline{SI(G)}}{\sum L_1(u)}$
Labelled Cluster Nirmala Index of (G)	$CNLI(G) = \frac{NLI(G)}{\sum L_I(u)}$
Labelled Cluster Sombor Index of (G)	$CSOLI(G) = \frac{\overline{SOLI}(G)}{\sum L_{I}(u)}$
Labelled Cluster Forgotten Index of (G)	$CFI(G) = \frac{\overline{FI(G)}}{\sum L_{i}(\mu)}$
	Topological indicesLabelled Incident of vertexLabelled Square Index of (G)Labelled Product Index of (G)Labelled Sum Index of (G)Labelled Nirmala Index of (G)Labelled Sombar Index of (G)Labelled Forgotten Index of (G)Labelled Cluster Square Index of (G)Labelled Cluster Product Index of (G)Labelled Cluster Sum Index of (G)Labelled Cluster Sombor Index of (G)Labelled Cluster Sombor Index of (G)Labelled Cluster Forgotten Index of (G)





Computational techniques and results

In this section, we have done cordial labeling for molecular graphs and have discussed about the obtained results from the computational techniques that is different types of labelled topological indices of some molecular graphs as indicated in Table 2 and physicochemical properties of some molecular structures in Table 3 found at Chemspider.

Chloroquine: This structure has 22 atoms and 23 bonds, as displayed in Figure

1.

In the following, the cordial labelings are depicted.

 $\begin{array}{c} 1 \rightarrow 2 \rightarrow 3 \rightarrow 4 \rightarrow 5 \rightarrow 6 \rightarrow 7 \rightarrow 8 \rightarrow 9 \rightarrow \\ 10 \rightarrow 11 \rightarrow 12 \rightarrow 13 \rightarrow 14 \rightarrow 15 \rightarrow 16 \rightarrow \\ 17 \rightarrow 18 \rightarrow 19 \rightarrow 20 \rightarrow 21 \rightarrow 22 \\ 1 \rightarrow 1 \rightarrow 1 \rightarrow 0 \rightarrow 0 \rightarrow 1 \rightarrow 1 \rightarrow 0 \rightarrow 0 \rightarrow \\ 1 \rightarrow 0 \rightarrow 0 \rightarrow 1 \rightarrow 0 \rightarrow 1 \rightarrow 1 \rightarrow 0 \rightarrow 0 \rightarrow \\ 1 \rightarrow 0 \rightarrow 1 \rightarrow 0 \end{array}$

Edge Labelings are |1 - 1| = 0, |1 - 0| = 1 and L_1 (1)=sum of all the labelling of the edges incident to that vertex. We apply the same technique for all the vertices.



FIGURE 1 Chemical structure of chloroquine and its cordial labeling

Labelled topological indices of chloroquine

From the definition of labelled incident of a vertex

$$L_{I}(u) = \sum f(uv)$$

$$= 0 + 0 + 2 + 1 + 2 + 1 + 2$$

$$+ 1 + 1 + 2 + 1 + 1 + 1 + 1$$

$$+ 1 + 1 + 1 + 1 + 1 + 1 + 1$$

$$+ 1 = 24$$

$$SQI(G) = \sum L_{I}(u)^{2}$$

$$= 0 + 0 + 4 + 1 + 4 + 1 + 4$$

$$+ 1 + 1 + 4 + 1 + 1 + 1 + 1$$

$$+ 1 + 1 + 1 + 1 + 1 + 1 + 1$$

$$+ 1 = 32$$

$$SI(G) = \sum (L_{I}(u) + L_{I}(v)) =$$

$$= (0 + 0) + (0 + 2)$$

$$+ (2 + 1) + (1 + 2)$$

$$+ (2 + 1) + (1 + 0)$$

$$+ (1 + 2) + (2 + 1)$$

$$+(1 + 1) + (1 + 2)$$

$$+(2 + 2) + (2 + 1)$$

$$+(1 + 1) + (1 + 1)$$

$$+(1 + 1) + (1 + 1)$$

$$+(1 + 1) + (1 + 1)$$

$$+(1 + 1) + (1 + 1)$$

$$+(2 + 1) = 53$$

$$PI(G) = \sum (L_{I}(u)L_{I}(v))$$

$$= 0 + 0 + 2 + 2 + 2$$

$$+0 + 2 + 2 + 1 + 2$$

$$+4 + 2 + 1 + 1 + 1$$

$$+1 + 1 + 1 + 1 + 1$$

$$+1 + 1 + 1 + 1 + 1$$

$$+1 + 1 + 2 = 31$$

$$FI(G) = \sum L_{I}(u)^{2} + L_{I}(v)^{2}$$

$$= 0 + 4 + 5 + 5 + 5 + 1 + 5$$

$$+5 + 2 + 5 + 8 + 5 + 2 + 2$$

$$+2 + 2 + 2 + 2 + 2 + 2 + 2$$

$$+2 + 2 + 2 + 2 + 2 + 2 + 2 + 2$$

$$NLI(G) = \sum \sqrt{\left(L_{I}(u) + L_{I}(v)\right)}$$

= 0 + $\sqrt{2}$ + $\sqrt{3}$ + $\sqrt{3}$ + $\sqrt{3}$
+ 1 + $\sqrt{3}$ + $\sqrt{3}$ + $\sqrt{2}$ + $\sqrt{3}$
+ $\sqrt{4}$ + $\sqrt{3}$ + 10 $\sqrt{2}$ + $\sqrt{3}$ =
= 32.0949
$$SOLI(G) = \sum \sqrt{L_{I}(u)^{2} + L_{I}(v)^{2}}$$

= 0 + $\sqrt{4}$ + $8\sqrt{5}$ + $11\sqrt{2}$ + 2
+ 1 + $\sqrt{8}$ = 41.2733
 $CSQI(G) = \frac{SQI(G)}{\sum L_{I}(u)} = \frac{32}{24} = 1.3333$

$$CSI(G) = \frac{SI(G)}{\Sigma L_{I}(u)} = \frac{53}{24} = 2.2083 \quad CPI(G) = \frac{PI(G)}{\Sigma L_{I}(u)} = \frac{31}{24} = 1.2916$$
$$CNLI(G) = \frac{NLI(G)}{\Sigma L_{I}(u)} = \frac{32.0949}{24} = 1.3372$$
$$CSOLI(G) = \frac{SOLI(G)}{\Sigma L_{I}(u)} = \frac{41.2733}{24} = 1.7197$$
$$CFI(G) = \frac{FI(G)}{\Sigma L_{I}(u)} = \frac{75}{24} = 3.12$$

Hydroxychloroquine: It is a molecular graph of Hydroxychloroquine with 23 atoms and 24 bonds, as demonstrated in Figure 2.



FIGURE 2 Chemical structure of Hydroxychloroquine and its cordial labelling

 $SI(G) = \sum (L_I(u) + L_I(v)) = (1+2)$ Labelled topological indices of hydrochloroquine +(2+0)+(0+0)+(0+1)+(1+2) $L_{I}(u) = \sum f(uv) = 1 + 2 + 0 + 0 + 1 + 2$ +(2+1)+(1+2)+1+2+1+1+2+1+1+(1+2)+(2+1)+1+1+1+1+1+1+1+(1+1)+(1+2)+1+0+1=24+(2+2)+(2+1) $SQI(G) = \sum L_I(u)^2$ +(1+1)+(1+1)+(1+1)+(1+1)= 1 + 4 + 0 + 0 + 1 + 4 + 1+(1+1)+(1+1)+4+1+1+4+1+1+1+(1+1)+(1+1)+1+1+1+1+1+1+1+(1+1)+(1+1)+1+1=32+(1+1)= 54 $PI(G) = \sum (L_I(u)L_I(v)) = 2 + 0 + 0 + 0$ +2+2+2+2+2+1+2+4+2+1+1+1+1+1+1+1+1+1+1+0= 31



$$FI(G) = \sum L_{I}(u)^{2} + L_{I}(v)^{2}$$

$$= (1+4) + (4+0) + (0+0) + (0+1) + (1+4) + (1+4) + (1+4) + (1+4) + (1+4) + (1+4) + (1+1) + (1+1) + (1+1) + (1+1) + (1+1) + (1+1) + (1+1) + (1+1) + (1+1) + (1+1) + (1+1) + (1+1) + (1+1) + (1+1) + (1+1) + (1+1) + (1+1) + (1+1) = 76$$

$$NLI(G) = \sum \sqrt{(L_{I}(u) + L_{I}(v))}$$

$$= \sqrt{3} + \sqrt{2} + 0 + 1 + \sqrt{3} + \sqrt{3} + \sqrt{3} + \sqrt{3} + \sqrt{3} + \sqrt{3} + \sqrt{2} + \sqrt{2$$

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$$SOLI(G) = \sum \sqrt{L_{I}(u)^{2} + L_{I}(v)^{2}}$$

= 4 + 8\sqrt{5} + 11\sqrt{2} + \sqrt{8}
= 40.2733
$$CSQI(G) = \frac{SQI(G)}{\sum L_{I}(u)} = \frac{32}{24}$$

= 1.3333
$$CSI(G) = \frac{SI(G)}{\sum L_{I}(u)} = \frac{54}{24} = 2.25$$

$$CPI(G) = \frac{PI(G)}{\sum L_{I}(u)} = \frac{31}{24} = 1.2916$$

$$CNLI(G) = \frac{NLI(G)}{\sum L_{I}(u)} = \frac{34.8269}{24} = 1.4511$$

$$CSOLI(G) = \frac{SOLI(G)}{\sum L_{I}(u)} = \frac{40.2733}{24} = 1.6780$$

$$CFI(G) = \frac{FI(G)}{\sum L_{I}(u)} = \frac{76}{24} = 3.$$

REMDISIVER: It is a molecular graph of Remdesivir with 41 atoms and 44 bonds as illustrated in Figure 3.





FIGURE 3 Chemical structure of Remdesivir and its cordial labelling

Labelled topological indices of remdisiver

(3+2) + (2+1) + (1+0) +

(0+1) + (1+1) + (1+1) +(1+1) + (1+0) + (3+1) +(3+1) + (1+1) + (1+1) +(1+1) + (1+1) + (1+2) +(1+1) + (2+1) + (1+1) +(1+0) + (1+0) + (2+1) +(2+0) + (1+2) + (1+1) +(1+1) + (1+2) + (2+2) +(2+1) + (2+1) + (1+1) +(1+1) + (1+1) + (1+0) = 110 $PI(G) = \sum (L_I(u)L_I(v)) = 0 + 1 + 1 + 1$ +1+1+2+2+6+3+3+3+6+3+0+0+1+1+1+1+3+3+1+1+1+1+2+2+1+0+0+2+0+2+1+1+2+4+2+2+1+1+1+0 = 71 $FI(G) = \sum L_I(u)^2 + L_I(v)^2$ = 1 + 2 + 2 + 2 + 2 + 2 + 5 + 5 + 13 + 10+10+10+13+5+1+1+2+2+2+2+10+10+2+2+2+2+5+5+2++5+4+5+2+2+5+8+5+5+2++2+ 0 = 181 $NLI(G) = \sum \sqrt{\left(L_I(u) + L_I(v)\right)}$

$$= 1 + \sqrt{2} + \sqrt{2} + \sqrt{2} + \sqrt{2} + \sqrt{2} + \sqrt{4} + \sqrt{3} + \sqrt{3} + \sqrt{5} + \sqrt{4} + \sqrt{4} + \sqrt{4} + \sqrt{5} + \sqrt{3} + \sqrt{1} + \sqrt{1} + \sqrt{4} + \sqrt{5} + \sqrt{3} + \sqrt{1} + \sqrt{1} + \sqrt{2} + \sqrt{3} + \sqrt{2} + \sqrt{2} + \sqrt{3} + \sqrt{2} + \sqrt{2} + \sqrt{3} + \sqrt{4} + \sqrt{3} + \sqrt{2} + \sqrt{2} + \sqrt{3} + \sqrt{4} + \sqrt{3} + \sqrt{3} + \sqrt{2} + \sqrt$$

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$$CFI(G) = \frac{FI(G)}{\sum L_I(u)} = \frac{75}{24} = 1.7272$$

FAVIPIRAVIR: It is a molecular graph of **Favipiravir** with 11 atoms and 11 bonds, as shown in Figure 4.



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FIGURE 4 Chemical structure of favipiravir and its cordial

Labelled topological indices of favipiravir

$$\sum L_{I}(u) = 1 + 3 + 1 + 1 + 1 + 1 + 2 + 0$$

+ 1 + 0 = 12
$$SQI(G) = \sum L_{I}(u)^{2} = 1 + 9 + 1 + 1 + 1$$

+ 1 + 4 + 0 + 1 + 0 = 20
$$SI(G) = \sum (L_{I}(u) + L_{I}(v))$$

= (1 + 3) + (3 + 1) + (1 + 1) + (1 + 1)
+ (1 + 1) + (1 + 2)
+ (2 + 3) + (1 + 0)(1 + 1)
+ (1 + 0) + (1 + 1) = 28
$$PI(G) = \sum (L_{I}(u)L_{I}(v)) = 3 + 3 + 1 + 1$$

+ 1 + 2 + 6 + 0 + 1 + 0 + 1
= 19
$$FI(G) = \sum L_{I}(u)^{2} + L_{I}(v)^{2}$$

= (1 + 9) + (9 + 1) + (1 + 1) + (1 + 1)
+ (1 + 1) + (1 + 4)
+ (4 + 9)
+ (1 + 0)(1 + 1) + (1 + 0) + (1 + 1) = 50

$$\begin{split} NLI(G) &= \sum \sqrt{\left(L_{I}(u) + L_{I}(v)\right)} \\ &= \sqrt{4} + \sqrt{4} + \sqrt{2} + \sqrt{2} + \sqrt{2} \\ &+ \sqrt{3} + \sqrt{5} + 1 + \sqrt{2} + 1 \\ &+ \sqrt{2} = 17.039 \\ SOLI(G) &= \sum \sqrt{L_{I}(u)^{2} + L_{I}(v)^{2}} \\ &= 0 + \sqrt{4} + 8\sqrt{5} + 11\sqrt{2} + 2 \\ &+ 1 + \sqrt{8} = 21.2372 \\ CSQI(G) &= \frac{SQI(G)}{\Sigma L_{I}(u)} = \frac{20}{12} = 1.6666 \\ CSI(G) &= \frac{SI(G)}{\Sigma L_{I}(u)} = \frac{28}{12} = 2.3333 \\ CPI(G) &= \frac{PI(G)}{\Sigma L_{I}(u)} = \frac{19}{12} = 1.5833 \\ CNLI(G) &= \frac{NLI(G)}{\Sigma L_{I}(u)} = \frac{17.039}{12} = 1.4199 \\ CSOLI(G) &= \frac{SOLI(G)}{\Sigma L_{I}(u)} = \frac{21.2372}{12} = 1.7697 \\ CFI(G) &= \frac{FI(G)}{\Sigma L_{I}(u)} = \frac{50}{12} \end{split}$$

RIBAVIRIN: It is a molecular graph of **RIBAVIRIN** with 17 atoms and 18 bonds, as specified in Figure 5.

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FIGURE 5 Chemical structure of ribavirin and its cordial labeling

Labelled topological indices of ribavirin

$$\sum L_{I}(u) = 1 + 2 + 3 + 1 + 2 + 1 + 1 + 0$$

+ 0 + 2 + 1 + 2 + 1 + 1 + 0
+ 0 + 0 = 18
$$SQI(G) = \sum L_{I}(u)^{2}$$

= 1 + 4 + 9 + 1 + 4 + 1 + 1
+ 0 + 0 + 4 + 1 + 4 + 1 + 1
+ 0 + 0 + 4 + 1 + 4 + 1 + 1
+ 0 + 0 + 0 = 32
$$SI(G) = \sum (L_{I}(u) + L_{I}(v))$$

= (1 + 2) + (2 + 3) + (3 + 1) + (1 + 2)
+ (2 + 1) + (1 + 1)
+ (1 + 3) + (1 + 0)
+ (1 + 0)(2 + 2) + (2 + 1)
+ (1 + 2) + (2 + 1)
+ (1 + 2) + (2 + 1)
+ (1 + 2) + (2 + 1)
+ (1 + 1) + (1 + 0)
+ (0 + 0) + (0 + 0) = 43
$$PI(G) = \sum (L_{I}(u)L_{I}(v)) = 2 + 6 + 3 + 2+ 2 + 1 + 3 + 0 + 0 + 4 + 2+ 2 + 2 + 1 + 1 + 0 + 0 + 0= 31$$

$$FI(G) = \sum L_{I}(u)^{2} + L_{I}(v)^{2}$$

= 5 + 13 + 10 + 5 + 5 + 2
+ 10 + 1 + 1 + 8 + 5 + 5
+ 5 + 2 + 2 + 1 + 0 + 0
= 80

$$NLI(G) = \sum \sqrt{(L_I(u) + L_I(v))}$$

= $\sqrt{3} + \sqrt{5} + \sqrt{4} + \sqrt{3} + \sqrt{3} + \sqrt{2} + \sqrt{4} + \sqrt{1} + \sqrt{1} + \sqrt{4} + \sqrt{3} + \sqrt{3} + \sqrt{3} + \sqrt{2} + \sqrt{2} + \sqrt{1} + \sqrt{1} + \sqrt{4} + \sqrt{3} + \sqrt{3} + \sqrt{3} + \sqrt{2} + \sqrt{2} + 1 + 0 + 0 = 25.8710$
$$SOLI(G) = \sum \sqrt{L_I(u)^2 + L_I(v)^2}$$

= $\sqrt{5} + \sqrt{13} + \sqrt{10} + \sqrt{5} + \sqrt{5} + \sqrt{2} + \sqrt{10} + \sqrt{1} + \sqrt{1} + \sqrt{8} + \sqrt{5} + \sqrt{2} + \sqrt{2} + 1 + 0 + 0$
$$CSQI(G) = \frac{SQI(G)}{\Sigma L_I(u)} = \frac{32}{24} = 2.2083$$

$$CPI(G) = \frac{PI(G)}{\Sigma L_I(u)} = \frac{31}{24} = 2.2083$$

$$CNLI(G) = \frac{NLI(G)}{\Sigma L_I(u)} = \frac{32.0949}{24} = 1.3372$$

$$CSOLI(G) = \frac{SOLI(G)}{\Sigma L_I(u)} = \frac{41.2733}{24} = 1.7197$$

$$CFI(G) = \frac{FI(G)}{\Sigma L_I(u)} = \frac{72}{20} = 3.6$$

THALIDOMIDE: It is a molecular graph of **THALIDOMIDE** with 19 atoms and 21 bonds, as shown in Figure 6.



FIGURE 6 Chemical structure of thalidomide and its cordial labelling

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Labelled topological indices of thalidomide

$$FI(G) = \sum L_{I}(u)^{2} + L_{I}(v)^{2} = 5 + 8 + 5$$

$$+ 2 + 2 + 2 + 2 + 1 + 2 + 1$$

$$+ 0 + 1 + 5 + 5 + 1 + 2 + 5$$

$$+ 5 + 5 + 5 + 8 = 72$$

$$NLI(G) = \sum \sqrt{(L_{I}(u) + L_{I}(v))}$$

$$= \sqrt{3} + \sqrt{4} + \sqrt{3} + \sqrt{2} + \sqrt{2} + \sqrt{2} + \sqrt{2}$$

$$+ \sqrt{2} + 1 + 1 + 1 + 0 + \sqrt{3}$$

$$+ \sqrt{3} + 1 + \sqrt{2} + \sqrt{3} + \sqrt{3}$$

$$+ \sqrt{3} + \sqrt{4} + \sqrt{3} = 30.3416$$

$$SOLI(G) = \sum \sqrt{L_{I}(u)^{2} + L_{I}(v)^{2}} = 38.0307$$

$$CSQI(G) = \frac{SQI(G)}{\sum L_{I}(u)} = \frac{30}{20} = 1.5$$

$$CSI(G) = \frac{SI(G)}{\sum L_{I}(u)} = \frac{48}{20} = 2.4$$

$$CPI(G) = \frac{PI(G)}{\sum L_{I}(u)} = \frac{30}{20} = 1.5CNLI(G)$$

$$= \frac{NLI(G)}{\sum L_{I}(u)} = \frac{30.3416}{20}$$

$$= 1.51770$$

$$CSOLI(G) = \frac{SOLI(G)}{\sum L_{I}(u)} = \frac{38.0307}{20} = 1.9015$$

$$CFI(G) = \frac{FI(G)}{\sum L_{I}(u)} = \frac{72}{20} = 3.6$$

2-PHYNOXYETHANOL: This is a structure with 11 atoms and 11 bonds, as displayed in Figure 7.

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FIGURE 7 Chemical structure of 2-phynoxyethanol and its cordial labelling

Labelled topological indices of 2phynoxyethanol

$$\begin{split} L_{I}(u) &= \sum f(uv) = 1 + 1 + 0 + 1 + 1 + 1 \\ &+ 2 + 2 + 1 + 1 + 1 = 12 \\ SQI(G) &= \sum L_{I}(u)^{2} = 1 + 1 + 0 + 1 + 1 \\ &+ 1 + 4 + 4 + 1 + 1 + 1 \\ &= 16 \\ SI(G) &= \sum (L_{I}(u) + L_{I}(v)) \\ &= (1 + 1) + (1 + 0) + (0 + 1) + \\ (1 + 1) + (1 + 1) + (1 + 2) \\ &+ (2 + 2) + (2 + 1) + (1 + 1) \\ &+ (1 + 1) + (1 + 1) \\ &= 24 \\ PI(G) &= \sum (L_{I}(u)L_{I}(v)) = 1 + 0 + 0 + 1 \\ &+ 1 + 2 + 4 + 2 + 1 + 1 + 1 \\ &= 14 \\ FI(G) &= \sum L_{I}(u)^{2} + L_{I}(v)^{2} \\ &= (1 + 1) + (1 + 0) + (0 + 1) \\ &+ (1 + 1) + (1 + 1) \\ &+ (1 + 4) + (4 + 4) \\ &+ (4 + 1) + (1 + 1) \\ &+ (1 + 1) + (1 + 1) \\ &= 32 \\ NLI(G) &= \sum \sqrt{(L_{I}(u) + L_{I}(v))} = \sqrt{2} + 1 + 1 \\ 1 + \sqrt{2} + \sqrt{2} + \sqrt{3} + \sqrt{4} + \sqrt{3} + \sqrt{2} + \sqrt{2} + \\ \sqrt{2} &= 15.9493 \end{split}$$

$$SOLI(G) = \sum \sqrt{L_{I}(u)^{2} + L_{I}(v)^{2}}$$

$$= \sqrt{2} + 1 + 1 + \sqrt{2} + \sqrt{2}$$

$$+ \sqrt{5} + \sqrt{8} + \sqrt{5} + \sqrt{2} + \sqrt{2}$$

$$+ \sqrt{2} = 17.7858$$

$$CSQI(G) = \frac{SQI(G)}{\Sigma L_{I}(u)} = \frac{16}{12}$$

$$= 1.3333$$

$$CSI(G) = \frac{SI(G)}{\Sigma L_{I}(u)} = \frac{24}{12} = 2$$

$$CPI(G) = \frac{PI(G)}{\Sigma L_{I}(u)} = \frac{14}{12} = 1.1667$$

$$CNLI(G) = \frac{NLI(G)}{\Sigma L_{I}(u)} = \frac{15.9493}{12} = 1.3291$$

$$CSOLI(G) = \frac{SOLI(G)}{\Sigma L_{I}(u)} = \frac{17.7858}{12}$$

$$= 1.4822$$

$$CFI(G) = \frac{FI(G)}{\Sigma L_{I}(u)} = \frac{24}{12} = 2.6666$$



TABLE 2 Computed values of the different types of labelled topological indices of some molecular graphs

01												
Name of the					M	lolecular	r Descripto	rs				
compound	SQI(G)	SI(G)	PI(G)	NLI(G)	SOLI(G)	FI(G)	CSQI(G)	CSI(G)	CPI(G)	CNLI	CSOLI	CFI
CHLOROQUINE	32	53	31	32.0949	41.2733	75	1.3333	2.2083	1.2916	1.3372	1.7197	3.125
HYDROCHLOROQUINE	32	54	31	34.8269	40.2733	76	1.3333	2.25	1.2916	1.4511	1.6780	3.1667
REMDISIVIR	66	110	71	68.0769	82.08165	181	1.5	2.5	1.75	1.5472	1.8655	1.7272
FAVIPIRAVIR	20	28	19	17.039	21.2372	50	1.6666	2.3333	1.5833	1.4199	1.7697	4.1666
RIBAVIRIN	32	43	32	25.8710	33.4176	80	1.7778	2.3889	1.7778	1.4372	1.8565	4.4444
THALIDOMIDE	30	48	30	30.3416	38.0307	68	1.5	2.4	1.5	1.5170	1.9015	3.6
2-PHENOXYETHONAL	16	24	14	15.9493	17.7858	146	1.3333	2	1.16666	1.3291	1.4821	2.6666
THALIDOMIDE 2-PHENOXYETHONAL	30 16	48 24	30 14	30.3416 15.9493	38.0307 17.7858	68 146	1.5 1.3333	2.4 2	1.5 1.16666	1.5170 1.3291	1.9015 1.4821	3.6 2.6666

TABLE 3 Physicochemical properties of some molecular structures

Name of the compoundz	Molar Refractivity	Polar surface	Polarizability	Molar Volume	Surface Tension	Log p	Boiling point	Flash Point
CHLOROQUINE	97.4	28	38.6	287.9	44	4.69	460.6	232.3
HYDROCHLOROQUINE	99	48	39.2	285.4	49.8	3.77	516.7	266.3
REMDISIVIR	149.5	213	59.3	409	62.7	2.10	-	-
FAVIPIRAVIR	33.2	89	13.2	97.2	81.5	0.78	552.6	288.0
RIBAVIRIN	51.1	144	20.3	117.1	106.8	2.26	639.8	340.7
THALIDOMIDE	65.2	87	25.9	161.0	71.6	0.03	487.8	248.8
2-PHENOXYETHANOL	39.1	29	15.5	127.4	40.0	1.16	245.2	105.3

Regression models

To fit the curves, regression models are used. Accordingly, we will look at linear, quadratic, cubic, logarithmic, and exponential regression models in this article. We may see the squared coefficient of correlation (R^2), F-ratio test, and significance in the regression model table (sig). The best predictor or goodness of fit of the regression model is the maximum (R^2), Fratio test should be larger than once for efficient model and significance value should be less than 0.05, then topological indices reliably predict the dependent variable for the specific physicochemical feature.

Main results

The linear, quadratic, exponential, and cubic regression models are obtained by using the

data in Tables 2 and 3 with the SPSS software. Tables 4, 5, and 6 shows the square of the correlation coefficient R^2 obtained by the linear regression model between various topological indices and physicochemical properties of chloroquine, hydroxychloroquine, Favipiravir, а remdesivir, ribavirin, and thalidomide drugs used in the treatment of COVID-19 patients. In the following, a few best predictors of the topological index regression models were indicated for the particular physicochemical property.

It is evident that Figures 8-10 depict the plots of linear, logarithmic, cubic, quadratic, and exponential regression models of the molar refractivity with SOLI(G),NLI(G),SI(G). Figure 11 demonstrates the regression models of the polar surface with CSI(G).

TABLE 4 Regression models between labelled topological indices and physicochemical property(Molar Refractivity and Polar surface) of some molecular structures

	Mo	olar Refractiv	vity			Polar	surface	
Regression models	Molecular descriptor	R ²	F	Significance	Molecular descriptor	R ²	F	Significance
Linear	SQI(G)	0.875196	42.075331	0.000638	SQI(G)	0.698670	13.911701	0.009739
Quadratic		0.877854	17.967309	0.005214		0.714837	6.266926	0.043424
Cubic		0.886841	10.449530	0.023083		0.730023	3.605353	0.123665
Logarithmic		0.601619	9.060950	0.023696		0.407911	4.133616	0.088280
Exponential		0.877854	11.312897	0.015164		0.603380	9.127831	0.023360
Linear	SI(G)	0.924927	73.921949	0.000136	SI(G)	0.698670	13.911701	0.009739
Quadratic		0.935740	36.404459	0.001047		0.714837	6.266926	0.043424
Cubic		0.957116	29.758469	0.003398		0.730023	3.605353	0.123665
Logarithmic		0.618955	9.746166	0.020536		0.407911	4.133616	0.088280
Exponential		0.633754	10.382452	0.018087		0.603380	9.127831	0.023360
Linear	PI(G)	0.854287	35.176693	0.001025	PI(G)	0.724193	15.754345	0.007374

Cordial label	ling of mole	ecular struc	tures and		Eurasian	(IN) S	Р	age 1099
					Communicatio	ons	-ADVIT	
Quadratic		0.866265	16.193634	0.006541		0.730120	6.763372	0.037838
Cubic		0.869020	8.846364	0.030726		0.739931	3.793513	0.115223
Logarithmic		0.627333	10.100150	0.019122		0.439897	4.712310	0.072983
Exponential		0.589167	8.604472	0.026173		0.566732	7.848237	0.031104
Linear	NLI(G)	0.930473	80.297575	0.000108	NLI(G)	0.596765	8.879656	0.024641
Quadratic		0.942051	40.641228	0.000808		0.616762	4.023355	0.090923
Cubic		0.962722	34.434070	0.002573		0.736354	3.723956	0.118240
Logarithmic		0.654735	11.377940	0.014985		0.379691	3.672606	0.103782
Exponential		0.635762	10.472749	0.017772		0.508225	6.200699	0.047155
Linear	SOLI(G)	0.923107	72.030943	0.000146	SOLI(G)	0.612198	9.471814	0.021729
Quadratic		0.929624	33.023620	0.001314		0.632438	4.301565	0.081908
Cubic		0.944097	22.517510	0.005749		0.736028	3.717702	0.118517
Logarithmic		0.634022	10.394439	0.018045		0.380730	3.688826	0.103176
Exponential		0.644016	10.854667	0.016518		0.525371	6.641461	0.041932
Linear	FI(G)	0.002056	0.012364	0.915090	FI(G)	0.354859	3.300289	0.119169
Quadratic		0.451014	2.053853	0.223307		0.184001	1.414889	0.325875
Cubic		0.457763	1.125618	0.438378		0.736616	3.728991	0.118018
Logarithmic		0.219690	1.689250	0.241398		0.273022	2.253345	0.184001
Exponential		0.126563	0.869411	0.387102		0.375723	3.611112	0.106127
Linear	CSOI(G)	0.007397	0.044712	0.839534	CSOI(G)	0.475624	5.442179	0.058413
Ouadratic		0.600486	3.757609	0.100886		0.477522	2.284893	0.197319
Cubic		0.600486	3.757609	0.100886		0.478673	2.295457	0.196234
Logarithmic		0.025177	0.154961	0.707447		0.473426	5.394401	0.059239
Exponential		0.279098	2.322901	0.178319		0.776249	20.815551	0.003841
Linear	CSI(G)	0.423400	4.405825	0.080588	CSI(G)	0.436309	4.644122	0.074587
quadratic	(-)	0.460841	2.136852	0.213448	()	0.823055	11.628645	0.013170
Cubic		0.464406	2.167712	0.209937		0.845969	13.730509	0.009312
Logarithmic		0.398308	3.971883	0.093333		0.362795	3.416115	0.114063
exponential		0.860641	37.054345	0.000894		0.930409	80.217490	0.000108
Linear	CPI(G)	0.216463	1.657584	0.245359	CPI(G)	0.841231	31.790870	0.001333
quadratic		0.291117	1.026675	0.423094		0.884218	19.092297	0.004561
Cubic		0.291117	0.291117	0.423094		0.885126	19.262938	0.004473
Logarithmic		0.239953	1.894250	0.217881		0.804105	24.628664	0.002545
exponential		0.357223	3.334497	0.117628		0.818659	27.086897	0.002006
Linear	CNLI(G)	0.473105	5.387467	0.059360	CNLI(G)	0.500293	6.007042	0.049728
quadratic		0.506451	2.565353	0.171130		0.681384	5.346436	0.057302
Cubic		0.510637	2.608681	0.167524		0.683079	5.388389	0.056543
Logarithmic		0.456366	5.036847	0.065957		0.460543	5.122296	0.064261
exponential		0.822765	27.853286	0.001869		0.922932	71.853320	0.000147
Linear	CSOLI(G)	0.380928	3.691933	0.103060	CSOLI(G)	0.463030	5.173806	0.063267
quadratic		0.385420	1.567818	0.296105	(-)	0.615866	4.008141	0.091455
Cubic		0.386019	1.571786	0.295384		0.619314	4.067088	0.089417
Logarithmic		0.384294	3.744917	0.101116		0.416572	4.284046	0.083911
exponential		0.776187	20.808057	0.003844		0.906529	58.191328	0.000265
Linear	CFI(G)	0.002766	0.016641	0.901573	CFI(G)	0.029818	0.184406	0.682607
quadratic	- (-)	0.298546	1.064025	0.412096	()	0.055704	0.147476	0.866503
Cubic		0.529499	1.500527	0.342776		0.619477	2.170616	0.234131
Logarithmic		0.007904	0.047804	0.834176		0.031906	0.197745	0.672139
exponential		0.456859	1.582649	0.255121		0.367888	3.491996	0.110880



Model Summary									
R	R Square	Adjusted R Square	Std. Error of the Estimate						
.951	.905	.857	15.664						
The independent variable is SOLI(G)									

		ANO	VA					
	Sum of Squares	df	Mean Square	F	Sig.			
Regression	9336.985	2	4668.492	19.027	.009			
Residual	981.433	4	245.358					
Total	10318.417	6						
The independent variable is SOLI(G)								

FIGURE 8 Regression model of SOLI(G) with molar refractivity



Model Summary									
R	R Square	R Square Square F							
.966	.933	.89	99	13.168	}				
-	The independent variable is NLI(G)								
ANOVA									
Sum of df Mean F Sig. Squares Square									
Regression	n 9624.817	2	4812.40	3 27.753	.005				
Residual	693.601	4	173.400	1					
Total	10318.417	76							
The independent variable is NLI(G)									

FIGURE 9 regression model of NLI(G) with molar refractivity



FIGURE 10 Regression model SI(G) with molar refractivity



FIGURE 11 Regression model CSI (G) with polar surface



- Ð SAMI

TABLE 5 Regression models between labelled topological indices and physicochemical property (**Polarizability & Molar Volume**) of some molecular structures

Pregressin models Molecular (descriptor) R ² P Spann(ance barlow Nolecular (descriptor) R ² P Spann(ance barlow) R ² P Spann(ance barlow) R ² Display Display <thdisplay< th=""> Display Display</thdisplay<>		Polariza	bility		Molar Volume				
Linear SQI(G) 0.872475 71.369921 0.001377 0.37934 1.531826 0.532718 0.52211 Cubic 0.885227 10.283831 0.023733 0.590659 11.92335 0.267324 Cubic 0.885227 10.283831 0.023733 0.590659 11.92335 0.267324 Caparthmic 0.58363 8.418336 0.002780 0.037666 0.034128 0.885921 Quadratic 0.932582 3.452266 0.001180 8.66464 1.701375 0.00284 Linear 0.661028 9.03663 0.023810 0.554755 8.79305 0.024642 Linear PI(G) 0.857494 3.008125 0.554716 7.454044 0.03455 Cubic 0.866908 8.690233 0.031667 0.851314 12.929099 0.004455 Cubic 0.938023 3.8351801 0.000254 0.835431 10.20790 0.018524 cuparthmic 0.637141 10.537179 0.017552 0.631014 10.260790 0.018524	Regression models	Molecular descriptor	R ²	F	Significance	Molecular descripto r	R ²	F	Significance
quadratic 0.874175 17.366921 0.001377 0.37933 1.531626 0.02753 Lagarithmic 0.583663 8.418336 0.027283 0.05556 0.031218 0.05575 Lanear SI(G) 0.924637 73.614793 0.000138 SI(G) 0.846593 38.1301 0.0005388 Gubic 0.957508 30.045390 0.003337 0.894174 11.26622 0.022464 Lagarithmic 0.610128 9.038663 0.022160 0.855116 7.456444 0.034653 Lagarithmic 0.862917 15.737069 0.006225 0.554116 7.456444 0.032267 Quadratic 0.862917 15.737069 0.006258 0.835131 12.99999 0.004555 Lagarithmic 0.610120 9.389341 0.022106 0.831647 12.050793 0.006622 Quadratic 0.938033 8.351801 0.000264 0.837247 8.150593 0.000452 Quadratic 0.946290 3.460559 0.007540 0.855493 0.018524	Linear	SQI(G)	0.872877	41.198201	0.000675	SQI(G)	0.006273	0.037878	0.852111
Cubic 0.885227 10.28383 0.023733 0.990659 19.23935 0.267324 exponential 0.721762 15.564239 0.007580 0.239861 1.89329 0.217983 quadratic 0.924637 73.614793 0.00138 SIG 0.867624 17.70175 0.002819 cubic 0.937508 0.0045390 0.003337 0.894174 11.266022 0.022424 Legarithmic 0.601028 9.038663 0.023810 0.555116 7.456404 0.03157 Linear PI(G) 0.853944 35.001217 0.001032 PI(G) 0.872478 41.050793 0.000455 Guadratinic 0.866908 8.690233 0.031667 0.865111 12.299099 0.004455 Linear NL(G) 0.932137 7.975823 0.00109 NL(G) 0.872478 41.050593 0.00662 Quadratic 0.932863 3.351801 0.009264 0.83131 12.29909 0.004455 Cubic 0.932863 7.541463 0.001794 <	quadratic		0.874175	17.368921	0.001377		0.379934	1.531826	0.302758
Logarithmic 0.583863 8.418336 0.027283 0.0005565 0.2394128 0.085521 exponential 0.721762 15.564293 0.0007380 0.6464593 38.10871 0.000819 guadratic 0.935582 3.582286 0.001180 0.876575 8.879305 0.002242 Logarithmic 0.051028 9.038663 0.023310 0.554116 7.56404 0.024642 exponential 0.7166444 15.026398 0.000285 0.554116 0.456404 0.034157 guadratic 0.366980 6.690233 0.00132 P(G) 0.872478 41.050593 0.000682 guadratic 0.660672 11.681992 0.014180 0.55606 7.541155 0.033463 Linear NLI(G) 0.938033 38.51801 0.00926 0.88511 19.298099 0.004455 Logarithmic 0.610721 15.247663 0.007926 0.88507 16.51159 0.033463 Logarithmic 0.610721 15.41659 0.0001752 0.631041 12.60949	Cubic		0.885227	10.283831	0.023733		0.590659	1.923935	0.267324
exponential 0.721762 15.564293 0.007580 0.239861 1.892389 0.217983 quadratic 0.924637 73.614793 0.000138 0.616593 38.310871 0.000819 Cubic 0.957508 30.045390 0.003337 0.894174 11.266022 0.0224642 exponential 0.714644 15.026398 0.008205 0.554716 7.456440 0.034157 Linear PI(G) 0.862971 15.737069 0.00652 0.883511 19.298099 0.004652 Cubic 0.666908 8.690233 0.0212106 0.631014 10.260790 0.018524 exponential 0.661020 9.399341 0.022106 0.631014 10.260790 0.018524 exponential 0.661028 0.001254 0.001264 0.930267 12.450342 0.0168524 Linear NLI(G) 0.937478 41.050593 0.000452 quadratic 0.938633 0.002549 0.81161 10.650790 0.81524 quadratic 0.6378181 <td< td=""><td>Logarithmic</td><td></td><td>0.583863</td><td>8.418336</td><td>0.027283</td><td></td><td>0.005656</td><td>0.034128</td><td>0.859521</td></td<>	Logarithmic		0.583863	8.418336	0.027283		0.005656	0.034128	0.859521
Linear SI(G) 0.024637 73.614793 0.0001180 0.8765246 17.701375 0.000319 Quadratic 0.932582 33.852266 0.001180 0.876575 8.879305 0.002242 Logarithmic 0.01028 90.33663 0.0023310 0.954747 1.156022 0.022422 cynonential 0.714644 15.025398 0.000132 0.554116 0.7546404 0.031347 quadratic 0.3653948 35.081217 0.001032 0.987377 1.2450342 0.10004455 cynonential 0.666672 1.1681992 0.0014180 0.556606 7.541159 0.033463 cynonential 0.666672 1.1681992 0.001452 0.663111 10.250790 0.000862 quadratic 0.93803 38351801 0.000926 0.83311 19.260790 0.018524 logarithmic 0.661721 1.5247663 0.000740 0.55606 7.541159 0.033463 logarithmic 0.932562 3.845226 0.0011302 0.066167 0.171616	exponential		0.721762	15.564293	0.007580		0.239861	1.893289	0.217983
quadratic 0.932582 34.582286 0.001180 0.876246 17.01375 0.003388 Cubic 0.957508 30.045390 0.003337 0.894174 11.266022 0.022442 Logarithmic 0.601028 9.038663 0.023810 0.596755 8.939305 0.024642 Linear PI(G) 0.453944 35.081217 0.001032 PI(G) 0.872478 41.050593 0.000682 Cubic 0.866290 8.690233 0.031667 0.903267 12.450342 0.0109682 Linear NLI(G) 0.930213 79.7975832 0.00109 NLI(G) 0.872478 41.050593 0.000485 Logarithmic 0.6370181 10.537179 0.002549 0.933267 12.450342 0.0168524 quadratic 0.938033 3.851801 0.000254 0.031041 10.260790 0.018524 cayonential 0.6374181 10.537179 0.017552 0.631014 10.260790 0.018524 Linear SLI(G) 0.947484 3.508264 0.	Linear	SI(G)	0.924637	73.614793	0.000138	SI(G)	0.864593	38.310871	0.000819
Cubic 0.957508 30.045390 0.00337 0.894174 11.266022 0.022422 exponential 0.716444 15.026398 0.002810 0.554116 7.86404 0.034157 Linear PI(G) 0.853948 35.081217 0.001032 PI(G) 0.872478 41.050593 0.0006425 Cubic 0.866980 86.09233 0.001167 0.903267 12.450342 0.016952 Logarithmic 0.610721 16.81992 0.0014180 0.556060 7.541159 0.033463 Linear NLI(G) 0.938033 35.31801 0.000926 0.883211 19.298099 0.004455 Quadratic 0.963270 0.603267 0.83181 15.29808 0.001752 0.631041 10.260790 0.018524 Logarithmic 0.933267 73.614793 0.000138 S0LI(G) 0.856976 7.541159 0.033463 Logarithmic 0.717616 15.247663 0.007211 0.666817 15.20161 0.009292 Quadratic 0.717616 15	quadratic		0.932582	34.582286	0.001180		0.876246	17.701375	0.005388
Logarithmic 0.61028 9.038663 0.023810 0.596755 8.879305 0.024642 unear PI(G) 0.852914 15.026398 0.008205 0.554116 7.45644 0.000652 unbic 0.862917 15.737069 0.006953 0.887311 19.298099 0.004455 Cubic 0.862917 15.737069 0.006952 0.881311 19.248099 0.001452 copantimic 0.610120 9.39231 0.021160 0.631014 10.260790 0.018524 exponential 0.66072 11.681992 0.0114180 0.556906 7.541159 0.03463 Logarithmic 0.637181 10.537179 0.017552 0.631014 10.260790 0.018524 exponential 0.717616 15.247663 0.007940 0.556906 7.541159 0.033463 Linear SOLI(G) 0.92463 7.3614793 0.00138 SOLI(G) 0.456280 0.632161 10.36776 0.022446 Linear SOLI(G) 0.9458403 0.0493337 0.66	Cubic		0.957508	30.045390	0.003337		0.894174	11.266022	0.020242
exponential 0.714644 15.026398 0.008205 0.554116 7.456404 0.034157 Linear PI(G) 0.853948 35.081217 0.001032 PI(G) 0.872478 41.050593 0.000662 Cubic 0.866980 8.690233 0.031667 0.903267 12.450342 0.0116968 Logarithmic 0.610672 11.681992 0.00119 NLIG 0.865310 0.001824 quadratic 0.932013 79.975832 0.00119 NLIG 0.885311 19.298099 0.004455 quadratic 0.962900 34.605599 0.002549 0.903267 12.450342 0.010468 Logarithmic 0.637181 10.537779 0.017552 0.631014 0.026349 0.0032467 Logarithmic 0.932582 34.582266 0.001180 0.865877 16.139630 0.006538 Cubic 0.9325503 30.045390 0.002341 0.561946 9.027476 0.027441 Logarithmic 0.61028 9.038663 0.023317 0.6608045 <	Logarithmic		0.601028	9.038663	0.023810		0.596755	8.879305	0.024642
Linear PI(G) 0.852917 0.00692 PI(G) 0.872478 41.0505939 0.000455 Cubic 0.8662917 15.737069 0.006958 0.885311 12.2450342 0.010485 Cubic 0.8660910 8.690233 0.02166 0.631014 10.260709 0.018524 exponential 0.666072 11.681992 0.001418 0.556906 7.541159 0.003463 quadratic 0.930213 79.975832 0.031104 10.260790 0.0018524 cuparithmic 0.936203 34.605599 0.000249 0.93267 12.450342 0.010495 Linear SOLI(G) 0.717616 15.247663 0.007940 0.556906 7.541159 0.033453 Linear SOLI(G) 0.945508 3.045390 0.003337 0.608045 9.037866 0.022449 cuparithmic 0.610128 9.038663 0.023317 0.608045 9.037876 0.022449 Logarithmic 0.61028 2.038764 0.007521 0.51498 7.697016 0.0	exponential		0.714644	15.026398	0.008205		0.554116	7.456404	0.034157
quadratic 0.866990 0.006958 0.881531 19.298099 0.004455 Logarithmic 0.610120 9.389341 0.02106 0.631014 10.260790 0.018524 Lexponential 0.660672 11.681992 0.014180 0.556906 7541159 0.033463 Linear NLI(G) 0.938803 38351801 0.000926 0.887311 19.298099 0.0004455 Cubic 0.938803 38351801 0.000926 0.887311 19.248099 0.0004455 Logarithmic 0.637181 10.537179 0.017552 0.631014 10.260790 0.018524 Logarithmic 0.717616 15.247663 0.00138 S0LI(G) 0.856977 16.335630 0.000538 Cubic 0.935582 34.652266 0.007321 0.561948 5.425363 0.0022446 Logarithmic 0.61028 9.038663 0.023310 0.608045 9.307876 0.0222486 Logarithmic 0.456298 2.183914 0.201751 F(G) 0.447485 5.42539	Linear	PI(G)	0.853948	35.081217	0.001032	PI(G)	0.872478	41.050593	0.000682
Cubic 0.066980 8.690233 0.031667 0.903257 12.450342 0.016968 exponential 0.660672 11.681992 0.014180 0.55060 7.541159 0.033463 quadratic 0.930213 79.975832 0.000026 0.887247 841.05593 0.000662 Quadratic 0.936203 38.65599 0.002549 0.932667 12.450342 0.016524 Cubic 0.637181 10.537177 0.017552 0.631014 10.260790 0.018524 exponential 0.717616 15.247663 0.007940 0.555996 7.541159 0.033463 Linear SDLI(G) 0.924637 7.3614793 0.001330 0.660845 9.307876 0.022481 Logarithmic 0.935508 30.045390 0.003327 0.660845 9.307876 0.022481 Logarithmic 0.6712172 3.47854 0.07321 0.561948 7.697016 0.032237 quadratic 0.47831 15.804796 0.06721 0.486648 2.32537 0.163339 </td <td>quadratic</td> <td></td> <td>0.862917</td> <td>15.737069</td> <td>0.006958</td> <td></td> <td>0.885311</td> <td>19.298099</td> <td>0.004455</td>	quadratic		0.862917	15.737069	0.006958		0.885311	19.298099	0.004455
Logarithmic 0.610120 9.389341 0.022106 0.63114 10.260790 0.018524 Linear NLI(G) 0.932013 79.975832 0.000109 NLI(G) 0.875474 41.050593 0.000645 Quadratic 0.962900 34.605599 0.002549 0.93267 12.450342 0.01668 Logarithmic 0.637181 10.527179 0.017552 0.631014 10.260790 0.018524 uadratic 0.032582 34.582286 0.00138 SOLI(G) 0.83463 3.031463 Linear SOLIG(G) 0.924637 73.614793 0.000138 SOLI(G) 0.836857 16.139630 0.0032463 Logarithmic 0.601028 9.038663 0.023310 0.660845 9.307876 0.022446 exponential 0.724831 15.804796 0.007321 0.468587 5.436349 0.19165 Linear FI(G) 0.456921 5.088962 0.64915 FI(G) 0.47355 0.051701 Linear FI(G) 0.456960 5.139333 <td>Cubic</td> <td></td> <td>0.866980</td> <td>8.690233</td> <td>0.031667</td> <td></td> <td>0.903267</td> <td>12.450342</td> <td>0.016968</td>	Cubic		0.866980	8.690233	0.031667		0.903267	12.450342	0.016968
exponential 0.660672 11.681992 0.014180 0.556906 7.541159 0.033463 quadratic 0.93803 38.351801 0.000926 0.8872478 41.050593 0.000682 Cubic 0.962900 34.65599 0.002547 12.450342 0.016496 Logarithmic 0.671616 15.247663 0.007940 0.556906 7.541159 0.033463 exponential 0.717616 15.247663 0.007940 0.556906 7.541159 0.033463 updartic 0.924637 73.614793 0.001335 0.608045 9.307876 0.022481 cubic 0.925508 30.453390 0.0033371 0.668045 9.307876 0.022481 cupadratic 0.62128 2.183914 0.208127 0.468648 5.435393 0.0224931 quadratic 0.466258 2.183914 0.208171 0.434654 5.425395 0.058701 quadratic 0.466268 2.183914 0.208171 0.436648 2.052616 0.514790 2.376845 0.712485	Logarithmic		0.610120	9.389341	0.022106		0.631014	10.260790	0.018524
Linear NLIG 0.933803 79.975832 0.000109 NLIG 0.87378 41.050593 0.0004652 Quadratic 0.933803 38.35181 0.000256 0.885311 19.298099 0.004455 Logarithmic 0.637181 10.537179 0.017552 0.631014 10.260790 0.018524 exponential 0.717616 15.247663 0.007940 0.556906 7.541159 0.018524 Logarithmic 0.63124 0.932562 34.582286 0.001180 0.865877 16.139630 0.022446 Logarithmic 0.610128 9.038663 0.023310 0.608045 9.307876 0.022446 exponential 0.744831 15.804796 0.00721 0.486268 2.366349 0.189165 Cubic 0.715172 3.347854 0.136796 0.60845 9.307876 0.027441 Logarithmic 0.496629 2.13933 0.060667 0.473054 5.366448 0.059701 Logarithmic 0.496660 5.313933 0.060667 0.473059	exponential		0.660672	11.681992	0.014180		0.556906	7.541159	0.033463
quadratic 0.938003 38.351801 0.000264 0.893267 1.2450342 0.0164855 Logarithmic 0.637181 10.537179 0.017552 0.631141 10.260790 0.0138524 exponential 0.717616 15.247663 0.007940 0.5556906 7.541159 0.033463 Linear S0LI(G) 0.924637 73.614793 0.000138 S0LI(G) 0.888890 36.520161 0.000929 quadratic 0.9357508 30.045390 0.003337 0.608045 9.307876 0.027441 Logarithmic 0.61028 9.038663 0.023810 0.668045 9.307876 0.023247 quadratic 0.458921 5.08962 0.64915 FI(G) 0.474854 5.452395 0.058701 quadratic 0.466628 2.183914 0.208127 0.486648 2.366349 0.189375 Logarithmic 0.469629 4.145919 0.087911 0.437059 5.386484 0.059370 Logarithmic 0.469692 2.103962 0.21780 0.519700 <td>Linear</td> <td>NLI(G)</td> <td>0.930213</td> <td>79.975832</td> <td>0.000109</td> <td>NLI(G)</td> <td>0.872478</td> <td>41.050593</td> <td>0.000682</td>	Linear	NLI(G)	0.930213	79.975832	0.000109	NLI(G)	0.872478	41.050593	0.000682
Cubic 0.962900 34.605599 0.002549 0.02547 12.450342 0.016968 Logarithmic 0.637114 10.537179 0.017552 0.631014 10.260790 0.01852 unara SOLI(G) 0.924637 73.614793 0.000138 SOLI(G) 0.858890 36.520161 0.000629 quadratic 0.932562 34.582286 0.001180 0.865877 16.139630 0.002549 Cubic 0.937508 30.045390 0.00337 0.608045 9.307876 0.022448 exponential 0.724831 15.804796 0.007321 0.546045 0.32337 0.608045 9.307876 0.022449 quadratic 0.466258 2.183914 0.208127 0.466268 2.36549 0.18379 Linear 0.408629 4.145919 0.087911 0.430547 4.536421 0.077221 exponential 0.466680 5.313333 0.060667 0.473059 5.386484 0.059707 Linear CSQI(G) 0.044793 0.198975 0.25166	quadratic		0.938803	38.351801	0.000926		0.885311	19.298099	0.004455
Logarithmic 0.637181 10.537179 0.017552 0.631014 10.260790 0.018524 exponential 0.717616 15.247663 0.007940 0.556906 7.541159 0.033463 Linear SDLI(G) 0.924637 7.3614793 0.000138 SDLI(G) 0.858890 6.520161 0.000929 quadratic 0.957508 30.045390 0.003337 0.608045 9.307876 0.022486 exponential 0.74831 15.804796 0.007211 0.561948 7.697016 0.032237 uinear FI(G) 0.458921 5.088962 0.064915 FI(G) 0.448548 5.425395 0.058701 quadratic 0.406628 2.183914 0.208127 0.4866891 2.925037 0.163339 Logarithmic 0.404629 4.145919 0.087911 0.4430547 4.536421 0.077221 uadratic 0.456969 2.03393 0.606667 0.4730547 4.536421 0.057970 Logarithmic 0.463939 2.05264 0.519700	Cubic		0.962900	34.605599	0.002549		0.903267	12.450342	0.016968
exponential 0.717616 15.247663 0.007940 0.556906 7.541159 0.033463 Linear SOLI(G) 0.924582 34.582286 0.001180 0.858890 0.65889 0.0027441 Logarithmic 0.957508 30.045390 0.003337 0.668045 9.307876 0.0227441 Logarithmic 0.610102 9.038663 0.023810 0.668045 9.307876 0.0222486 exponential 0.724831 15.804796 0.007321 0.561948 7.697016 0.032237 quadratic 0.466258 2.183914 0.208127 0.486268 2.366349 0.189165 Cubic 0.715172 3.347854 0.136796 0.442454 4.534221 0.077221 exponential 0.466629 4.145919 0.087911 0.430547 4.5346421 0.077221 guadratic 0.456689 2.103962 0.217280 0.519700 2.705081 0.159875 Cubic 0.456799 0.257166 0.631475 CSQI(G) 0.42428 0.538249	Logarithmic		0.637181	10.537179	0.017552		0.631014	10.260790	0.018524
Linear quadraticS0LI(G)0.9246377.36.147930.000138S0LI(G)0.86587935.201610.00029quadratic0.95750830.0453900.0033370.6080459.3078760.027441Logarithmic0.6010289.0386630.0238100.6080459.3078760.022486exponential0.72443115.8047960.0073210.5619487.6470160.032237linearFI(G)0.4589215.0889620.064915FI(G)0.4748545.4253950.058701quadratic0.4662582.1839140.2081270.4862682.3663490.189165Cubic0.7151723.3478540.1367960.6866912.9250370.163339Logarithmic0.4086294.1459190.0879110.4305474.5364210.077221uadratic0.4569892.0251660.631475CSQI(G)0.242880.1493560.712485quadratic0.4569892.1039620.217280CSQI(G)0.242880.159875Logarithmic0.0709890.4584800.5235690.0514780.3256280.58962exponential0.2570442.0755810.1997220.3374123.060560.109569quadratic0.4483882.0321730.2259870.3948011.6308730.248435cubic0.7283090.9640860.4424640.2504110.8351630.486472Logarithmic0.3780222.6975060.1302760.3372123.5568090.108258exponentia	exponential		0.717616	15.247663	0.007940		0.556906	7.541159	0.033463
quadratic 0.932582 34.582286 0.001180 0.865877 16.139630 0.006588 Cubic 0.957508 30.045390 0.003337 0.608045 9.307876 0.027441 Logarithmic 0.601028 9.038663 0.023810 0.608045 9.307876 0.027441 Linear FI(G) 0.458921 5.088962 0.064915 FI(G) 0.474545 5.425355 0.058701 quadratic 0.466258 2.183914 0.208127 0.486268 2.366349 0.18339 Logarithmic 0.406629 4.145919 0.087911 0.4430547 4.536421 0.077221 cayonential 0.466606 5.313933 0.060667 0.473059 5.386484 0.059377 Linear CSQI(G) 0.0479712 2.105566 0.217280 0.519700 2.705081 0.159875 Logarithmic 0.070989 0.458480 0.523569 0.051478 0.325628 0.589962 Linear CSI(G) 0.463321 2.04640 0.2217900 0.3376	Linear	SOLI(G)	0.924637	73.614793	0.000138	SOLI(G)	0.858890	36.520161	0.000929
Cubic 0.957508 30.045390 0.003337 0.608045 9.307876 0.027441 Logarithmic 0.610428 9.038663 0.023810 0.668045 9.307876 0.022486 exponential 0.724831 15.804796 0.007321 0.561948 7.697016 0.032237 Linear PI(G) 0.456921 5.088962 0.064915 PI(G) 0.474854 5.425395 0.058701 quadratic 0.469628 2.163914 0.208127 0.486684 2.05377 0.163339 Logarithmic 0.406680 5.313933 0.060667 0.473059 5.386484 0.059377 Linear CSQI(G) 0.4457172 2.105506 0.217280 0.519700 2.705081 0.159875 Cubic 0.457172 2.105506 0.217098 0.51478 0.325628 0.189875 Logarithmic 0.07998 0.458480 0.523569 0.051478 0.325628 0.100769 quadratic 0.456337 2.32539 0.021490 0.386249 3.760056 </td <td>quadratic</td> <td></td> <td>0.932582</td> <td>34.582286</td> <td>0.001180</td> <td></td> <td>0.865877</td> <td>16.139630</td> <td>0.006588</td>	quadratic		0.932582	34.582286	0.001180		0.865877	16.139630	0.006588
Logarithmic 0.601028 9.038663 0.023810 0.608045 9.037876 0.022486 exponential 0.72481 15.804796 0.007321 0.56148 7.697016 0.032237 Linear FI(G) 0.458921 5.088962 0.064915 FI(G) 0.474854 5.425395 0.032237 quadratic 0.466258 2.183914 0.208127 0.486268 2.366349 0.189165 Cubic 0.715712 3.347854 0.136796 0.666801 2.92037 0.163339 Linear 0.469680 5.5119333 0.060667 0.473059 5.386484 0.059377 Linear 0.456989 2.103962 0.217280 0.519700 2.705081 0.159875 Logarithmic 0.475079 0.257044 2.075851 0.19722 0.337912 3.062242 0.130764 Linear CSI(G) 0.448388 2.032173 0.225987 0.334011 1.630873 0.284935 Cubic 0.458121 2.064640 0.221990 0.394621	Cubic		0.957508	30.045390	0.003337		0.608045	9.307876	0.027441
exponential 0.724831 15.804796 0.007321 0.561948 7.697016 0.032237 Linear FI(G) 0.45821 5.088962 0.064915 FI(G) 0.474854 5.425395 0.058701 quadratic 0.466258 2.183914 0.208127 0.486268 2.366349 0.189165 Cubic 0.715172 3.347854 0.136796 0.686681 2.925037 0.163339 Logarithmic 0.469680 5.313933 0.060667 0.473059 5.386484 0.059707 Linear CSQI(G) 0.046793 0.255166 0.611475 CSQI(G) 0.024288 0.149356 0.519700 2.705081 0.159875 Logarithmic 0.455172 2.103962 0.217298 0.519700 2.705081 0.159875 Logarithmic 0.0257044 2.075851 0.199722 0.337912 3.062242 0.130704 Linear CSI(G) 0.44838 2.032173 0.225987 0.337912 3.062242 0.13076 Logarithmic 0.458212 </td <td>Logarithmic</td> <td></td> <td>0.601028</td> <td>9.038663</td> <td>0.023810</td> <td></td> <td>0.608045</td> <td>9.307876</td> <td>0.022486</td>	Logarithmic		0.601028	9.038663	0.023810		0.608045	9.307876	0.022486
LinearFI(G)0.4589215.0889620.064915FI(G)0.4748545.4253950.058701quadratic0.4086282.189140.2081270.4862682.3663490.189165Cubic0.7151723.3478540.1367960.6868912.9250370.163339Logarithmic0.4086294.1459190.0879110.4305474.5364210.0772211LinearCSQI(G)0.0407930.2551660.631475CSQI(G)0.0242880.1493560.712485quadratic0.4569892.1039620.2172800.5197002.7050810.159875Logarithmic0.0709890.4584800.5235690.0514780.3256280.58962exponential0.2570442.0758510.1997220.3379123.0622420.100704LinearCSI(G)0.466354.1118210.088939CSI(G)0.3852493.760560.109569quadratic0.4483882.0321730.2259870.3948011.6308730.284935Cubic0.4523122.0646400.2219900.3962381.6407050.28326Logarithmic0.3809023.6915170.1030760.3721753.5566090.108258exponential0.7783090.9640860.4424640.2504110.8351630.486472Logarithmic0.2783090.9640860.4424640.2504110.8351630.486472Logarithmic0.3229271.8152440.2265320.1719891.2462780.36667Linear <t< td=""><td>exponential</td><td></td><td>0.724831</td><td>15.804796</td><td>0.007321</td><td></td><td>0.561948</td><td>7.697016</td><td>0.032237</td></t<>	exponential		0.724831	15.804796	0.007321		0.561948	7.697016	0.032237
quadratic0.4662582.1839140.2081270.4862682.3663490.189165Cubic0.7151723.3478540.1367960.6868912.9250370.163339Logarithmic0.4086294.1459190.0879110.4305474.5364210.077221exponential0.4696805.3139330.0606670.4730595.3864840.059377LinearCSQI(G)0.0479730.2551660.631475CSQI(G)0.0242880.1493560.712485quadratic0.4569892.1039620.2172800.5197002.7050810.159875Logarithmic0.0709890.4584800.5235690.0514780.3256280.589662exponential0.2570442.0758510.1997220.3379123.0622420.130704LinearCSI(G)0.4406354.1118210.089399CSI(G)0.3852493.7600560.100569quadratic0.4523122.0646400.2219900.3962381.6407050.283246Logarithmic0.3809023.6915170.1030760.3721753.5568090.108258exponential0.7983723.7525390.0027840.8630563.78135130.000848LinearCPI(G)0.2110271.591540.253320CPI(G)0.4846472Logarithmic0.2783090.9640860.4424640.2504110.8351630.486472Logarithmic0.2783090.9640860.4424640.2504110.8351630.486472Logarithmic0.329270	Linear	FI(G)	0.458921	5.088962	0.064915	FI(G)	0.474854	5.425395	0.058701
Cubic 0.715172 3.347854 0.136796 0.686891 2.925037 0.163339 Logarithmic 0.469629 4.145919 0.087911 0.430547 4.536421 0.077221 Linear CSQI(G) 0.04793 0.255166 0.631475 CSQI(G) 0.024288 0.149356 0.712485 quadratic 0.456989 2.103560 0.217280 0.519700 2.705081 0.159875 Cubic 0.457172 2.105506 0.217098 0.519700 2.705081 0.159875 Logarithmic 0.070989 0.458480 0.523569 0.051478 0.326228 0.588962 exponential 0.275044 2.075851 0.199722 0.337912 3.062242 0.130704 Linear CSI(G) 0.446338 2.032173 0.225987 0.394601 1.630873 0.284935 Cubic 0.45337 2.3752539 0.002784 0.365056 37.813513 0.00848 Linear CPI(G) 0.11027 1.596154 0.25320 CPI(G)	quadratic		0.466258	2.183914	0.208127		0.486268	2.366349	0.189165
Logarithmic0.4086294.1459190.0879110.4305474.5364210.077221exponential0.4696805.3139330.0606670.4730595.3864840.059377LinearCSQI(G)0.0407930.2551660.631475CSQI(G)0.0242880.1493560.712485quadratic0.4569892.1039620.2172800.5197002.7050810.159875Logarithmic0.0709890.4584800.5235690.0514780.3256280.588962exponential0.2570442.0758510.1997220.3379123.0622420.130704LinearCSI(G)0.4483882.021730.2259870.3948011.6308730.284935Cubic0.4523122.0646400.2219900.3962381.6407050.283246Logarithmic0.3809023.6915170.1030760.3721753.5568090.100858exponential0.7983372.37525390.0027440.86305637.8135130.000848LinearCPI(G)0.2101271.5961540.253320CPI(G)0.1487321.0483090.345392quadratic0.2783090.9640860.4424640.2504110.8351630.486472Logarithmic0.2322701.8152440.2265320.1719891.2462780.306967exponential0.3329832.9952680.1342280.2326652.8713480.141106LinearCNLI(G)0.440175.4565700.065331CNLI(G)0.4324570.0868316ex	Cubic		0.715172	3.347854	0.136796		0.686891	2.925037	0.163339
exponential0.4696805.3139330.0606670.4730595.3864840.059377LinearCSQI(G)0.04407930.2551660.631475CSQI(G)0.0242880.1493560.712485quadratic0.4569892.1039620.2172800.5197002.7050810.159875Logarithmic0.0709890.4584800.5235690.0514780.3256280.588962exponential0.2570442.0758510.199720.3379123.0622420.130704LinearCSI(G)0.466354.1118210.088939CSI(G)0.3852493.7600560.100569quadratic0.4483882.0321730.2259870.3948011.6308730.284935Cubic0.4523122.0646400.2219900.3962381.6407050.283246Logarithmic0.3809023.6915170.1030760.3721753.5568090.108258exponential0.79833723.7525390.0027840.86305637.8135130.000848LinearCPI(G)0.211271.5961540.25320CPI(G)0.1487321.0483090.345392quadratic0.2783090.9640860.4424640.2504110.8351630.486472Cubic0.2783090.9640860.4424640.2504110.8351630.486472Logarithmic0.2783090.9640860.4426440.2504110.8351630.486472Logarithmic0.2782090.9640860.442640.2504110.8351630.486472Logarith	Logarithmic		0.408629	4.145919	0.087911		0.430547	4.536421	0.077221
LinearCSQI(G)0.04407930.2551660.631475CSQI(G)0.0242880.1493560.712485quadratic0.4569892.1039620.2172800.5197002.7050810.159875Logarithmic0.0709890.4584800.5235690.0514780.3256280.588962exponential0.2570442.0758510.1997220.3379123.0622420.130704LinearCSI(G)0.4466354.1118210.088939CSI(G)0.3852493.7600560.100569quadratic0.4483882.0321730.2259870.3946011.6308730.284935Cubic0.4523122.0646400.2219900.3721753.5568090.108258exponential0.79833723.7525390.0027840.86305637.8135130.000848LinearCPI(G)0.2101271.5961540.253220CPI(G)0.1487321.0483090.345392quadratic0.2783090.9640860.4424640.2504110.8351630.486472Cubic0.2322701.8152440.2265320.1719891.2462780.306967exponential0.3329832.9952680.1342280.3236552.8713480.141106Logarithmic0.4402175.0655070.065381CNLI(G)0.4130721.8942250.241478Logarithmic0.4901562.4018580.1801940.4107464.1823670.0068831exponential0.78116221.4174830.0035860.80764825.1927460.002406 </td <td>exponential</td> <td></td> <td>0.469680</td> <td>5.313933</td> <td>0.060667</td> <td></td> <td>0.473059</td> <td>5.386484</td> <td>0.059377</td>	exponential		0.469680	5.313933	0.060667		0.473059	5.386484	0.059377
quadratic0.4569892.1039620.2172800.5197002.7050810.159875Cubic0.4571722.1055060.2170980.5197002.7050810.159875Logarithmic0.0709890.4584800.5235690.0514780.3256280.588962exponential0.2570442.0758510.1997220.3379123.0622420.130704LinearCSI(G)0.4066354.1118210.088939CSI(G)0.3852493.7602660.100569quadratic0.4483882.0321730.2259870.3948011.6308730.284935Cubic0.4523122.0646400.2219900.3962381.6407050.283246Logarithmic0.3809023.6915170.1030760.3721753.5568090.108258exponential0.79833723.7525390.0027840.86305637.8135130.000848LinearCPI(G)0.2101271.5961540.253320CPI(G)0.1487321.0483090.345392quadratic0.2783090.9640860.4424640.2504110.8351630.486472Cubic0.2783090.9640860.4424640.2504110.8351630.486472Logarithmic0.3222701.8152440.2265320.1719891.2462780.306967exponential0.3329832.9952680.1342280.3236652.8713480.141106LinearCNLI(G)0.4402175.0655070.065381CNLI(G)0.4324331.9118050.241718Logarithmi	Linear	CSQI(G)	0.040793	0.255166	0.631475	CSQI(G)	0.024288	0.149356	0.712485
Cubic0.4571722.1055060.2170980.5197002.7050810.159875Logarithmic0.0709890.4584800.5235690.0514780.3256280.588962exponential0.2570442.0758510.1997220.3379123.0622420.130704LinearCSI(G)0.4066354.1118210.088939CSI(G)0.3852493.7600560.100569quadratic0.4483882.0321730.2259870.3948011.6308730.284935Cubic0.4523122.0646400.2219900.3962381.6407050.283246Logarithmic0.3809023.6915170.1030760.3721753.5568090.108258exponential0.79833723.7525390.0027840.86305637.8135130.000848LinearCPI(G)0.2101271.5961540.253320CPI(G)0.1487321.0483090.345392quadratic0.2783090.9640860.4424640.2504110.8351630.486472Cubic0.2783090.9640860.4424640.2504110.8351630.486472Logarithmic0.322932.9952680.1342280.3236652.8713480.042254quadratic0.4961562.4618580.1801940.4310721.8942250.244143Cubic0.5007892.5079000.1760800.4333391.9118050.241718Logarithmic0.3695211.4652390.3156290.3545841.3734730.334656Cubic0.370451.468536<	quadratic		0.456989	2.103962	0.217280		0.519700	2.705081	0.159875
Logarithmic0.07/9890.4584800.5235690.0514780.0251280.588962exponential0.2570442.0758510.1997220.3379123.0622420.130704LinearCSI(G)0.4468382.0321730.2259870.3948011.6308730.284935Cubic0.4523122.0646400.2219900.3962381.6407050.283246Logarithmic0.3809023.6915170.103760.3721753.5568090.108258exponential0.79833723.7525390.0027840.86305637.8135130.000848LinearCPI(G)0.2101271.5961540.253320CPI(G)0.1487321.0483090.345392quadratic0.2783090.9640860.4424640.2504110.8351630.486472Logarithmic0.2322701.8152440.2265320.1719891.2462780.306967exponential0.3329832.9952680.1342280.3236652.8713480.141106LinearCNLI(G)0.4402175.0655070.065381CNLI(G)0.4199514.3439610.082254quadratic0.5007892.5079000.1760800.4333391.9118050.241718Logarithmic0.4402174.7184430.0028460.80764825.1927460.002406LinearCSDLI(G)0.3665211.4652390.3156290.3545841.3734730.334656Cubic0.370451.4685360.8101440.4107464.1823670.086831expone	Cubic		0.457172	2.105506	0.217098		0.519700	2.705081	0.159875
exponential0.25/0442.0738510.1997220.3379123.0622420.130704LinearCSI(G)0.4066354.1118210.088939CSI(G)0.3852493.7600560.100569quadratic0.4483882.0321730.2259870.3948011.6308730.284935Cubic0.4523122.0646400.2219900.3962381.6407050.283246Logarithmic0.3809023.6915170.1030760.3721753.5568090.108258exponential0.79833723.7525390.0027840.86305637.8135130.000848LinearCPI(G)0.2101271.5961540.253320CPI(G)0.1487321.0483090.345392quadratic0.2783090.9640860.4424640.2504110.8351630.486472Cubic0.2322701.8152440.2265320.1719891.2462780.306967exponential0.3329832.9952680.13412280.3236652.8713480.141106LinearCNLI(G)0.4402175.0655070.065381CNLI(G)0.4197464.1823670.086231Logarithmic0.4961562.4618580.1801940.4310721.8942250.244143Cubic0.5007892.5079000.1760800.4333391.9118050.241718Logarithmic0.402174.7184430.0025860.80764825.1927460.002406LinearCSOLI(G)0.3663273.4686010.111848CSOLI(G)0.3254332.8945980.13	Logarithmic		0.070989	0.458480	0.523569		0.051478	0.325628	0.588962
LinearCSI(G)0.446354.118210.088939CSI(G)0.3852493.7600560.100569quadratic0.4483882.0321730.2259870.3948011.6308730.283246Logarithmic0.3809023.6915170.1030760.3721753.5568090.108258exponential0.79833723.7525390.0027840.86305637.8135130.000848LinearCPI(G)0.2101271.5961540.253320CPI(G)0.1487321.0483090.345392quadratic0.2783090.9640860.4424640.2504110.8351630.486472Cubic0.2322701.8152440.2265320.1719891.2462780.306967exponential0.3329832.9952680.1342280.3236652.8713480.141106LinearCNLI(G)0.4402175.0655070.065381CNLI(G)0.410721.8942250.244143Quadratic0.4961562.4618580.1801940.4310721.8942250.244173Logarithmic0.4402174.7184430.0728410.4107464.1823670.08631exponential0.78116221.4174830.0035860.80764825.1927460.002406LinearCSOLI(G)0.3663273.468010.111848CSOLI(G)0.3254331.3134730.332699Quadratic0.3704551.4652390.3156290.3545841.3734730.334656Cubic0.3704551.4652360.3149740.3563291.3839730.3223	exponential	001(0)	0.257044	2.075851	0.199722	001(0)	0.33/912	3.062242	0.130/04
quadratic0.4483882.03217/30.2259870.3948011.6508730.2834453Cubic0.4523122.0646400.2219900.3962381.6407050.283246Logarithmic0.3809023.6915170.1030760.3721753.5568090.108258exponential0.79833723.7525390.0027840.86305637.8135130.000848LinearCPI(G)0.2101271.5961540.253320CPI(G)0.1487321.0483090.345392quadratic0.2783090.9640860.4424640.2504110.8351630.486472Logarithmic0.2322701.8152440.2265320.1719891.2462780.306967exponential0.3329832.9952680.1342280.3236652.8713480.141106LinearCNLI(G)0.4402175.0655070.065381CNLI(G)0.4199514.3439610.082254quadratic0.4901562.4618580.1801940.4310721.8942250.241433Logarithmic0.4402174.7184430.0728410.4107464.1823670.086831exponential0.78116221.4174830.0035860.80764825.1927460.002406LinearCSOLI(G)0.3663273.4686010.11848CSOLI(G)0.3545841.3734730.334656Ubic0.369511.4653690.3149740.3563291.3839730.332399Logarithmic0.3685753.5023170.1104570.3387513.0737390.130112 <td< td=""><td>Linear</td><td>CSI(G)</td><td>0.406635</td><td>4.111821</td><td>0.088939</td><td>CSI(G)</td><td>0.385249</td><td>3.760056</td><td>0.100569</td></td<>	Linear	CSI(G)	0.406635	4.111821	0.088939	CSI(G)	0.385249	3.760056	0.100569
Lubic0.4523122.0646400.2219900.3962381.6407050.283246Logarithmic0.3809023.6915170.1030760.3721753.5568090.108258exponential0.79833723.7525390.0027840.86056637.8135130.000848LinearCPI(G)0.2101271.5961540.253320CPI(G)0.1487321.0483090.345392quadratic0.2783090.9640860.4424640.2504110.8351630.486472Cubic0.2783090.9640860.4424640.2504110.8351630.486472Logarithmic0.2322701.8152440.2265320.1719891.2462780.306967exponential0.3329832.9952680.1342280.3236652.8713480.141106LinearCNLI(G)0.4402175.0655070.065381CNLI(G)0.4199514.3439610.082254quadratic0.4961562.4618580.1801940.4310721.8942250.244143Cubic0.5007892.5079000.1760800.4333391.9118050.241718Logarithmic0.4402174.7184430.0728410.4107464.1823670.086831exponential0.78116221.4174830.0028660.3254332.8945980.139779Quadratic0.3695211.4685360.3149740.3563291.3839730.332399Logarithmic0.3685753.5023170.1104570.3387513.0737390.130112Exponential0.724892<	quadratic		0.448388	2.0321/3	0.225987		0.394801	1.6308/3	0.284935
Logarithmic0.3809023.6915170.103760.3721753.5568090.108258exponential0.79833723.7525390.0027840.86305637.8135130.000848LinearCPI(G)0.2101271.5961540.253320CPI(G)0.1487321.0483090.345392quadratic0.2783090.9640860.4424640.2504110.8351630.486472Cubic0.2783090.9640860.4424640.2504110.8351630.486472Logarithmic0.2322701.8152440.2265320.1719891.2462780.306967exponential0.3329832.9952680.1342280.3236652.8713480.141106LinearCNLI(G)0.4402175.0655070.065381CNLI(G)0.4199514.3439610.082254quadratic0.4961562.4618580.1801940.4310721.8942250.241143Cubic0.5007892.5079000.1760800.4333391.9118050.241178Logarithmic0.4402174.7184430.0728410.4107464.1823670.086831exponential0.78116221.4174830.0035860.80764825.1927460.002406LinearCS0LI(G)0.3663273.4686010.111848CS0LI(G)0.354341.3734730.334556Cubic0.3700451.4652390.3156290.3545841.3734730.334556Cubic0.370451.4685360.3149740.3563291.3839730.332399Logarithmic	Cubic		0.452312	2.064640	0.221990		0.396238	1.640705	0.283246
exponential0.79833723.7525390.0027840.86305637.8135130.000848LinearCPI(G)0.2101271.5961540.25320CPI(G)0.1487321.0483090.345392quadratic0.2783090.9640860.4424640.2504110.8351630.486472Lobic0.2783090.9640860.4424640.2504110.8351630.486472Logarithmic0.2322701.8152440.2265320.1719891.2462780.306967exponential0.3329832.9952680.1342280.3236652.8713480.141106LinearCNLI(G)0.4402175.0655070.065381CNLI(G)0.4199514.3439610.082254quadratic0.4961562.4618580.1801940.4310721.8942250.244143Cubic0.5007892.5079000.1760800.4333391.9118050.241718Logarithmic0.4402174.7184430.0728410.4107464.1823670.086831exponential0.78116221.4174830.0035860.80764825.1927460.002406LinearCSUL(G)0.3663273.4686010.111848CSUL(G)0.3254332.8945980.139779Quadratic0.3695211.4652390.3156290.3545841.3734730.334656Cubic0.3700451.4685360.3149740.3563291.3839730.332399Logarithmic0.3685753.5023170.1104570.3387513.0737390.130112Exponen	Logarithmic		0.380902	3.691517	0.103076		0.3/21/5	3.556809	0.108258
LinearCPI(G)0.2101271.3591540.23320CPI(G)0.1487321.0483090.343392quadratic0.2783090.9640860.4424640.2504110.8351630.486472Cubic0.2322701.8152440.2265320.1719891.2462780.306967exponential0.3329832.9952680.1342280.3236652.8713480.141106LinearCNLI(G)0.4402175.0655070.065381CNLI(G)0.4199514.3439610.082254quadratic0.4961562.4618580.1801940.4310721.8942250.244143Cubic0.5007892.5079000.1760800.4333391.9118050.241718Logarithmic0.4402174.7184430.0728410.4107464.1823670.086831exponential0.78116221.4174830.0035860.80764825.1927460.002406LinearCSOLI(G)0.3663273.4686010.111848CSOLI(G)0.3254332.8945980.139779Quadratic0.3695211.4652390.3156290.3545841.3734730.334656Cubic0.3700451.4685360.3149740.3563291.3839730.332399Logarithmic0.3685753.5023170.1104570.3387513.0737390.130112Exponential0.72489215.8096490.0073150.75705618.6970170.004961LinearCFI(G)0.0047320.0285300.871420CFI(G)0.0062730.0378780.8521	exponential	CDI(C)	0.798337	23./52539	0.002784	CDI(C)	0.863056	37.813513	0.000848
quadratic0.2783090.9640860.4424640.2504110.8351630.486472Cubic0.2783090.9640860.4424640.2504110.8351630.486472Logarithmic0.2322701.8152440.2265320.1719891.2462780.306967exponential0.3329832.9952680.1342280.3236652.8713480.141106LinearCNLI(G)0.4402175.0655070.065381CNLI(G)0.4199514.3439610.082254quadratic0.4961562.4618580.1801940.4310721.8942250.244143Cubic0.5007892.5079000.1760800.4333391.9118050.241718Logarithmic0.4402174.7184430.0728410.4107464.1823670.086831exponential0.78116221.4174830.0035860.80764825.1927460.002406LinearCSOLI(G)0.3663273.4686010.111848CSOLI(G)0.3254332.8945980.139779Quadratic0.3695211.4652390.3156290.3545841.3734730.334656Cubic0.3700451.4685360.3149740.3387513.0737390.332399Logarithmic0.3685753.5023170.1104570.3387513.0737390.130112Exponential0.72489215.8096490.0073150.75705618.6970170.004961LinearCFI(G)0.0047320.0285300.871420CFI(G)0.062730.0378780.852111Quadr	Linear	CPI(G)	0.210127	1.596154	0.253320	CPI(G)	0.148/32	1.048309	0.345392
Cubic0.2783090.9640860.4424640.2304110.8351630.486472Logarithmic0.2322701.8152440.2265320.1719891.2462780.306967exponential0.3329832.9952680.1342280.3236652.8713480.141106LinearCNLI(G)0.4402175.0655070.065381CNLI(G)0.4199514.3439610.082254quadratic0.4961562.4618580.1801940.4310721.8942250.244143Cubic0.5007892.5079000.1760800.4333391.9118050.241718Logarithmic0.4402174.7184430.0728410.4107464.1823670.086831exponential0.78116221.4174830.0035860.80764825.1927460.002406LinearCSOLI(G)0.3663273.4686010.111848CSOLI(G)0.3254332.8945980.139779Quadratic0.3695211.4652390.3156290.3545841.3734730.334656Cubic0.3700451.4685360.3149740.3563291.3839730.32399Logarithmic0.3685753.5023170.1104570.3387513.0737390.130112Exponential0.72489215.8096490.0073150.75705618.6970170.004961LinearCFI(G)0.0047320.0285300.871420CFI(G)0.0062730.0378780.852111Quadratic0.2930731.0364320.4201810.3799341.5318260.302758Cubic	quadratic		0.278309	0.964086	0.442464		0.250411	0.835163	0.486472
Logarithmic0.2322701.8152440.2265320.1719891.2462780.308967exponential0.3329832.9952680.1342280.3236652.8713480.141106LinearCNLI(G)0.4402175.0655070.065381CNLI(G)0.4199514.3439610.082254quadratic0.4961562.4618580.1801940.4310721.8942250.244143Cubic0.5007892.5079000.1760800.4333391.9118050.241718Logarithmic0.4402174.7184430.0728410.4107464.1823670.086831exponential0.78116221.4174830.0035860.80764825.1927460.002406LinearCSOLI(G)0.3663273.4686010.111848CSOLI(G)0.3254332.8945980.139779Quadratic0.3695211.4652390.3156290.3545841.3734730.334656Cubic0.3700451.4685360.3149740.3563291.3839730.322399Logarithmic0.3685753.5023170.1104570.3387513.0737390.130112Exponential0.72489215.8096490.0073150.75705618.6970170.004961LinearCFI(G)0.0047320.0285300.871420CFI(G)0.0062730.0378780.852111Quadratic0.2930731.0364320.4201810.3799341.5318260.302758Cubic0.5212661.4517920.3533960.5906591.9239350.267324Loga	Loganithania		0.278309	0.964086	0.442464		0.250411	0.835103	0.486472
exponential0.323632.3932660.1342260.3236652.6713460.141106LinearCNLI(G)0.4402175.0655070.065381CNLI(G)0.4199514.3439610.082254quadratic0.4961562.4618580.1801940.4310721.8942250.244143Cubic0.5007892.5079000.1760800.4333391.9118050.241718Logarithmic0.4402174.7184430.0728410.4107464.1823670.086831exponential0.78116221.4174830.0035860.80764825.1927460.002406LinearCSOLI(G)0.3663273.4686010.111848CSOLI(G)0.3254332.8945980.139779Quadratic0.3700451.4652390.3156290.3545841.3734730.334656Cubic0.3700451.4685360.3149740.3563291.3839730.332399Logarithmic0.3685753.5023170.1104570.3387513.0737390.130112Exponential0.72489215.8096490.0073150.75705618.6970170.004961LinearCFI(G)0.0047320.0285300.871420CFI(G)0.0062730.0378780.852111Quadratic0.2930731.0364320.4201810.3799341.5318260.302758Cubic0.5212661.4517920.3533960.5906591.9239350.267324Logarithmic0.0051180.0308660.8663180.0056560.0341280.859521 <td>Logarithmic</td> <td></td> <td>0.232270</td> <td>1.815244</td> <td>0.220532</td> <td></td> <td>0.1/1989</td> <td>1.2402/8</td> <td>0.306967</td>	Logarithmic		0.232270	1.815244	0.220532		0.1/1989	1.2402/8	0.306967
LinearCNLI(G)0.4402175.0655070.065381CNLI(G)0.4199514.3439610.082254quadratic0.4961562.4618580.1801940.4310721.8942250.244143Cubic0.5007892.5079000.1760800.4333391.9118050.241718Logarithmic0.4402174.7184430.0728410.4107464.1823670.086831exponential0.78116221.4174830.0035860.80764825.1927460.002406LinearCSOLI(G)0.3663273.4686010.111848CSOLI(G)0.3254332.8945980.139779Quadratic0.3695211.4652390.3156290.3545841.3734730.334656Cubic0.3700451.4685360.3149740.3563291.3839730.332399Logarithmic0.3685753.5023170.1104570.3387513.0737390.130112Exponential0.72489215.8096490.0073150.75705618.6970170.004961LinearCFI(G)0.0047320.0285300.871420CFI(G)0.0062730.0378780.852111Quadratic0.2930731.0364320.4201810.3799341.5318260.302758Cubic0.5212661.4517920.3533960.5906591.9239350.267324Logarithmic0.0051180.0308660.8663180.0056560.0341280.859521	Lincor	CNULCO	0.332983	2.995268	0.134228	CNULCO	0.323005	2.8/1348	0.141106
quadratic0.4361362.4616360.1301940.4310721.6942230.244143Cubic0.5007892.5079000.1760800.4333391.9118050.241718Logarithmic0.4402174.7184430.0728410.4107464.1823670.086831exponential0.78116221.4174830.0035860.80764825.1927460.002406LinearCSOLI(G)0.3663273.4686010.111848CSOLI(G)0.3254332.8945980.139779Quadratic0.3695211.4652390.3156290.3545841.3734730.334656Cubic0.3700451.4683660.3149740.3563291.3839730.332399Logarithmic0.3685753.5023170.1104570.3387513.0737390.130112Exponential0.72489215.8096490.0073150.75705618.6970170.004961LinearCFI(G)0.0047320.0285300.871420CFI(G)0.0062730.0378780.852111Quadratic0.2930731.0364320.4201810.3799341.5318260.302758Cubic0.5212661.4517920.3533960.5906591.9239350.267324Logarithmic0.0051180.0308660.8663180.0056560.0341280.859521	Lilleal	CNLI(G)	0.440217	3.003307 2.4610E0	0.005501	CNLI(G)	0.419951	4.343901	0.002254
Cubic0.3007692.3079000.1780800.4333391.9118050.241718Logarithmic0.4402174.7184430.0728410.4107464.1823670.086831exponential0.78116221.4174830.0035860.80764825.1927460.002406LinearCSOLI(G)0.3663273.4686010.111848CSOLI(G)0.3254332.8945980.139779Quadratic0.3695211.4652390.3156290.3545841.3734730.334656Cubic0.3700451.4683660.3149740.3563291.3839730.332399Logarithmic0.3685753.5023170.1104570.3387513.0737390.130112Exponential0.72489215.8096490.0073150.75705618.6970170.004961LinearCFI(G)0.0047320.0285300.871420CFI(G)0.0062730.0378780.852111Quadratic0.2930731.0364320.4201810.3799341.5318260.302758Cubic0.5212661.4517920.3533960.5906591.9239350.267324Logarithmic0.0051180.0308660.8663180.0056560.0341280.859521	quadratic		0.496156	2.401858	0.180194		0.431072	1.894225	0.244143
Logarithmic0.4402174.7184430.0728410.4407464.1823670.080831exponential0.78116221.4174830.0035860.80764825.1927460.002406LinearCSOLI(G)0.3663273.4686010.111848CSOLI(G)0.3254332.8945980.139779Quadratic0.3695211.4652390.3156290.3545841.3734730.334656Cubic0.3700451.4685360.3149740.3563291.3839730.332399Logarithmic0.3685753.5023170.1104570.3387513.0737390.130112Exponential0.72489215.8096490.0073150.75705618.6970170.004961LinearCFI(G)0.0047320.0285300.871420CFI(G)0.0062730.0378780.852111Quadratic0.2930731.0364320.4201810.3799341.5318260.302758Cubic0.5212661.4517920.3533960.5906591.9239350.267324Logarithmic0.0051180.0308660.8663180.0056560.0341280.859521	Logarithmia		0.500789	2.507900	0.176080		0.433339	1.911805	0.241/18
Exponential0.74110221.4174830.0033860.0033680.007482.51927460.002408LinearCSOLI(G)0.3663273.4686010.111848CSOLI(G)0.3254332.8945980.139779Quadratic0.3695211.4652390.3156290.3545841.3734730.334656Cubic0.3700451.4685360.3149740.3563291.3839730.332399Logarithmic0.3685753.5023170.1104570.3387513.0737390.130112Exponential0.72489215.8096490.0073150.75705618.6970170.004961LinearCFI(G)0.0047320.0285300.871420CFI(G)0.0062730.0378780.852111Quadratic0.2930731.0364320.4201810.3799341.5318260.302758Cubic0.5212661.4517920.3533960.5906591.9239350.267324Logarithmic0.0051180.0308660.8663180.0056560.0341280.859521	ovpopoptial		0.440217	4.710443	0.072041		0.410740	4.102307 25 102746	0.000031
LinearC30L1(G)0.303273.4680010.111848C30L1(G)0.3234332.3943960.139479Quadratic0.3695211.4652390.3156290.3545841.3734730.334656Cubic0.3700451.4685360.3149740.3563291.3839730.332399Logarithmic0.3685753.5023170.1104570.3387513.0737390.130112Exponential0.72489215.8096490.0073150.75705618.6970170.004961LinearCFI(G)0.0047320.0285300.871420CFI(G)0.0062730.0378780.852111Quadratic0.2930731.0364320.4201810.3799341.5318260.302758Cubic0.5212661.4517920.3533960.5906591.9239350.267324Logarithmic0.0051180.0308660.8663180.0056560.0341280.859521	Lincar	CSOLUCE	0.761102	21.41/403	0.003300	CSOLUCE	0.007040	23.192740	0.002400
Quadratic0.3695211.4632390.3130290.3130290.3343641.3734730.334303Cubic0.370451.4685360.3149740.3563291.3839730.332399Logarithmic0.3685753.5023170.1104570.3387513.0737390.130112Exponential0.72489215.8096490.0073150.75705618.6970170.004961LinearCFI(G)0.0047320.0285300.871420CFI(G)0.0062730.0378780.852111Quadratic0.2930731.0364320.4201810.3799341.5318260.302758Cubic0.5212661.4517920.3533960.5906591.9239350.267324Logarithmic0.0051180.0308660.8663180.0056560.0341280.859521	Quadratic	CSOLI(G)	0.300327	3.400001	0.111040	CSOLI(G)	0.323433	2.094390	0.139779
Logarithmic0.3685753.5023170.1149740.3305291.3039730.352399Logarithmic0.3685753.5023170.1104570.3387513.0737390.130112Exponential0.72489215.8096490.0073150.75705618.6970170.004961LinearCFI(G)0.0047320.0285300.871420CFI(G)0.0062730.0378780.852111Quadratic0.2930731.0364320.4201810.3799341.5318260.302758Cubic0.5212661.4517920.3533960.5906591.9239350.267324Logarithmic0.0051180.0308660.8663180.0056560.0341280.859521	Cubic		0.309321	1.403239	0.313029		0.334304	1.373473	0.334030
Logarithmic0.3003733.3023170.1104370.3307313.0737390.130112Exponential0.72489215.8096490.0073150.75705618.6970170.004961LinearCFI(G)0.0047320.0285300.871420CFI(G)0.0062730.0378780.852111Quadratic0.2930731.0364320.4201810.3799341.5318260.302758Cubic0.5212661.4517920.3533960.5906591.9239350.267324Logarithmic0.0051180.0308660.8663180.0056560.0341280.859521	Logarithmic		0.370043	1.400000 2 502217	0.3149/4		0.330329	1.3037/3	0.332399
LipearCFI(G)0.0047320.0285300.871420CFI(G)0.0062730.0378780.852111Quadratic0.2930731.0364320.4201810.3799341.5318260.302758Cubic0.5212661.4517920.3533960.5906591.9239350.267324Logarithmic0.0051180.0308660.8663180.0056560.0341280.859521	Evpopontial		0.300373	15 800640	0.110437		0.550751	18 607017	0.130112
LinearCrif(d)0.0047320.0203300.0203300.071420Crif(d)0.0002730.0378780.032111Quadratic0.2930731.0364320.4201810.3799341.5318260.302758Cubic0.5212661.4517920.3533960.5906591.9239350.267324Logarithmic0.0051180.0308660.8663180.0056560.0341280.859521	Linoar	CEI(C)	0.724092	0 028230	0.007313	CERC	0.757050	0.037979	0.004901
Quantiant0.230731.0304320.4201010.379341.3318200.302750Cubic0.5212661.4517920.3533960.5906591.9239350.267324Logarithmic0.0051180.0308660.8663180.0056560.0341280.859521	Quadratic	Grifter	0.004/32	1 036422	0.071420	Griffin	0.000273	1 521076	0.032111
Logarithmic 0.005118 0.030866 0.866318 0.005656 0.034128 0.859521	Cubic		0.293073	1 451792	0.720101		0.579934	1 922925	0.302730
Logarianine 0.003110 0.030000 0.000310 0.0003030 0.034120 0.037321	Logarithmic		0.021200	0.030866	0.3333370		0.005656	0.034128	0.207324
Exponential 0.332983 2.995268 0.134228 0.239861 1.893289 0.217983	Exponential		0.332983	2,995268	0.134228		0.239861	1.893289	0.217983





Model SummaryRR SquareAdjusted RStd. Error of the SquareSquareEstimate								
.980	.9	59	.93	35	4.	709		
The independent variable is NLI(G)								
ANOVA								
		Sum of Squares	df	Mear Squar	n F	Sig.		
Regres	sion	2621.93	2 3	873.97	77 39.4	.001 22		
Resid	lual	110.850) 5	22.17	0			
Total 2732.782 8								
The independent variable is NLI(G)								

FIGURE 12 Regression model NLI(G) with polarizability





Figure 12 displays the plots of linear, logarithmic, cubic, quadratic, and exponential regression models of the polarizability with NLI(G). Figure 13 shows the regression models of the molar volume with CSI.

Figure 14 indicates the plots of linear,

logarithmic, cubic, quadratic, and exponential regression models of the surface tension with CSQI (G) and Figure 15 demonstrates the regression models of boiling point with CFI (G).



TABLE 6 Regression models between labelled topological indices and physicochemical pr	operty
(Surface Tension & Boiling Point) of some molecular structures	

Regression models	Molecular descriptor	R ²	F	Significance	Molecular descriptor	R ²	F	Significance
Linear	SOI(G)	0.206587	1.562269	0.257875	SOI(G)	0.003011	0.018121	0.897319
Ouadratic	- (-(-)	0.525406	2.767656	0.155170	- (-(-)	0.889579	20.140628	0.004052
Cubic		0.556815	1.675189	0.308293		0.891259	10.928256	0.021350
Logarithmic		0.493083	5.836257	0.052158		0.192166	1.427268	0.277290
Exponential		0 362259	3 408212	0 114401		-	-	-
Linear	SIG	0 1 2 9 8 8 2	0.895617	0 380497	SI(G)	0.013605	0.082756	0 783274
Quadratic	bi(d)	0.414219	1 767803	0.262627	bi(d)	0.862555	15 689062	0.007004
Cubic		0.617342	2 506096	0 164495		0.872305	9 108227	0.029239
Logarithmic		0.448621	4 881811	0.069193		0.184217	1 354894	0.288613
Evponential		0.294624	2 506096	0.164495		-	-	-
Linear	PI(G)	0.129882	0.895617	0.380497	PI(G)	0 397718	3 301766	0 1 2 8 8 9 3
Quadratic	i i(d)	0.414219	1 767803	0.262627	i i(u)	0.850022	11 335266	0.022493
Cubic		0.617342	2 151067	0.236534		0.840841	10 566023	0.025332
Logarithmic		0.448621	4 881811	0.069193		0.167313	1 004656	0.362197
Exponential		0 294624	2 506096	0 164495		-	-	-
Linear	NLI(G)	0.118642	0.807678	0.403430	NLIG	0 455823	4 188194	0.096069
Quadratic	NEI(U)	0.387636	1 582538	0.403430	NEI(U)	0.455025	6 643492	0.053540
Cubic		0.610616	2 429472	0.275445		0.757160	6 235866	0.053940
Logarithmic		0.420710	4 357501	0.081885		0.256729	1 727022	0.245849
Evponential		0.288212	2 429472	0.001005		-	-	-
Linear	SOLIG	0.139622	0.973678	0.361870	SOLIG	0 413780	3 529225	0 1 1 9 0 8 7
Quadratic	30EI(U)	0.137022	1 821502	0.252078	30LI(U)	0.913700	8 158085	0.038758
Cubic		0.422033	2 151840	0.235070		0.785460	7 222284	0.030730
Logarithmic		0.017420	4 966410	0.230437		0.703400	1 210142	0.040027
Evponential		0.447840	2 620551	0.009320		0.193901	1.210145	0.319909
Lincar	FIC	0.505320	2.039331	0.1333339	FICC	-	-	-
Quadratia	FILG	0.059270	1.605059	0.301230	FI(G)	0.071095	34.029901 34.02026E	0.002095
Quadratic		0.404100	2 000 4 1 1	0.274014		0.925450	24.030303	0.005557
Logarithmia		1.095950	2.000411	0.244403		0.925701	12.459200	0.033004
Europontial		0.369397	3.020347	0.096224		0.765979	10.302215	0.007825
Lincor	CEDICO	0.205199	2.105470	0.191554	CEDICO	-	-	-
Quadratia	CSQI(G)	0.977994	200.030011	0.000005	CSQI(G)	0.140034	0.059149	0.390310
Quadratic		0.970375	113.104097	0.000069		0.370340	2.439000	0.107732
Logarithmia		0.976446	113.400223	0.000000		0.151407	1.192925	0.392330
Europontial		0.904403	102.03/90/	0.000014		0.450601	5.745055	0.047075
Lincor	CSI(C)	0.766930	19.745562	0.004359	CELICE	-	-	-
Lilleal	CSI(G)	0.000520	F 904220	0.013419	CSI(G)	0.001955	0.009/03	0.925055
Quadratic		0.696949	5.004250	0.049720		0.379202	1.052491	0.239249
Logarithmia		0.696970	5./5001/ 10.2467E0	0.050549		0.307739	1.900030	0.229492
ovponential		0.052933	117 200200	0.010214		0.339791	1.032491	0.099407
Lincor	CDI(C)	0.951574	25 151412	0.000037	CDI(C)	-	-	-
Lilleal	CPI(G)	0.007392	23.131413	0.002410	CPI(G)	0.000101	0.000004	0.000604
Cubic		0.040709	12 0000000	0.009200		0.100001	0.303433	0.704120
Logarithmic		0.040709	0.022051	0.009200		0.132393	0.001016	0.710093
Logaritininc		0.032031	0.032031	0.001501		0.000205	0.001010	0.975607
Lincor	CNULCO	0.569056	0.399003	0.020200	CNULCO	-	-	-
Lilleal	CNLI(G)	0.579009	0.201952	0.020137	CNLI(G)	0.002414	7 200064	0.300991
Quadratic		0.600106	3.731039	0.101120		0.764505	7.200904	0.040430
Logarithmia		0.602240	5./05199	0.099762		0.790737	7.557552	0.043791
Logarithmic		0.590094	8.03/49/	0.025983		0.052855	0.279024	0.619937
exponential	CCOLUC)	0.850/46	34.199889	0.001103		-	-	-
Linear	COULICE	0.725878	15./29549	0.00/400	COULI(G)	0.019424	0.122/20	0.7403//
quadratic		0./365/3	0.990310	0.035616		0.172505	0.416934	0.004/4/
LuDic		0./36559	0.909//4	0.035621		0.1/2505	0.410934	0.004/4/
Logarithmic		0.702645	14.1//882	0.009340		0.023956	0.122/20	0./403//
exponential	CELCO	0.902/92	55./23399	0.000298	CELCO		-	-
Linear	CFI(G)	0.702623	14.1/6412	0.009342	CFI(G)	0.884956	38.461458	0.001591
quadratic		0.726721	6.648150	0.039041		0.94/115	35.818100	0.002797
Cubic		0.903025	12.415858	12.415858		0.94/135	35.831918	0.002795
Logarithmic		0.65/250	11.50545/	0.014640		0.935635	/2.682368	0.000365
exponential		0.615014	9.584989	0.021226		-	-	-









FIGURE 15 Regression model CFI(G) with boiling point

Conclusion

Taken into account numerous variants of labelled topological indices, the regression models were used to analyze the molecular structure in this paper. The work could be a fresh effort to improve QSPR model prediction outcomes utilizing the labelled topological indices, which assist chemists come up with new medication design concepts. The study involves the use of favipiravir, ribavirin, remsedivir, chloroquine, and hydroxychloroquine. The molecular descriptors of those structures were originally discovered. The computed values of those components were then summarized.

According to the QSPR study, molecular descriptors [13] (topological indices) are the most effective instruments for predicting physicochemical qualities of pharmaceuticals employed for chemical, medical and pharmaceutical purposes. The regression models can be correlate to study the relationship between two variables like molecular descriptor and physicochemical properties. The molecular descriptors like NLI(G), CSQI(G), and SI(G) are best predicted with physicochemical properties like molar refractivity and polarizability. The molecular descriptor CSQI(G) is best predicted with surface tension. The findings of the aforementioned study could be applied to the development of new medications with chemical, medicinal, and pharmaceutical properties.

Disclosure statement

The authors declare that there is no conflict of interest regarding the publication of this article.

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Author's contributions

All the authors have made major contributions to this paper and they have all given their approval to the final version. The final manuscript was read and approved by all its authors.

Conflict of interest

No competing interests have been declared by the author

Orcid:

Vinutha S.V.: http://orcid.org/0000-0002-5576-6316 Shrikanth A.S.: https://orcid.org/0000-0003-4463-0533

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