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The Mathematical Foundation of the Pareto Rule

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ABSTRACT: *Vilfredo Pareto (1848-1923) once said: "For many events, roughly 80% of the effects come from 20% of the causes."*In this brief paper, I provide the well known AT Math to show why the Pareto Principle works.

KEYWORDS: Pareto Rule; Economics; AT Math.

INTRODUCTION

The relationship that indicates that 80% of the results come from 20% of the input is ubiquitous. It even is the underlying mathematics that forms the Cosmos. The reader should be aware by know of what I called AT Math. This is the math that relies on the mathematics that has the function equal to its derivative. In the case of the universe, it is energy and time that follow the Pareto Rule. To my knowledge, besides AT Math, the rule has not been treated to mathematical analysis. We provide that here.

$t=80\%=0.80$

$E=1/t=1/0.80=-1.25=Emin \Rightarrow GMP \ t_{min}=1/2$

$t^2-t-1=E$
$(1/2)^2-(1/2)-1=-1.25$

$M=Ln\ t=E$

$dE/dt=1/t=2t-1$

$2t^2-t=0$
$t(2t-1)=0$

$t=0: 1/2 \Rightarrow dE/dt=-t \quad y=-y'$

Eigen function
$t^2-t-1=2t-1$

Eigenvalue
$3^2-3-1=2(3)-1=5$
$t=3=c$; $E=5$

$E=e^{-t}=e^{-3}=1/20.0$

$E=1/t$
$1/20=1/0.80$

80% $\chi=20$

$\chi=25=5^2=c^2$

3-4-5 triangle

Pythagoras

$c^2=a^2+b^2$

$5^2=3^2+b^2$

$b^2=16$
$b=4=M=|D|$

$E=5=1/20\%$

$1/80\%=20\%$

$-1.25=1/5$

$E_{min}=1/E'=1/5$

$E'=1/E_{min}$

$E'=1/t_{min}=1/(1/2)=2$
$dE/dt=2t-1=E=2=d^2E/dt^2$

$2t=3$
$t=3/2=1.5=1/666=1/G \quad G=E' \Rightarrow$Clairaut Equation

$d^2E/dt^2-G=0$

$d^2E/dt^2-E=0$

QED

Now for the Loli Pop.

Spiral
$y=e^t$

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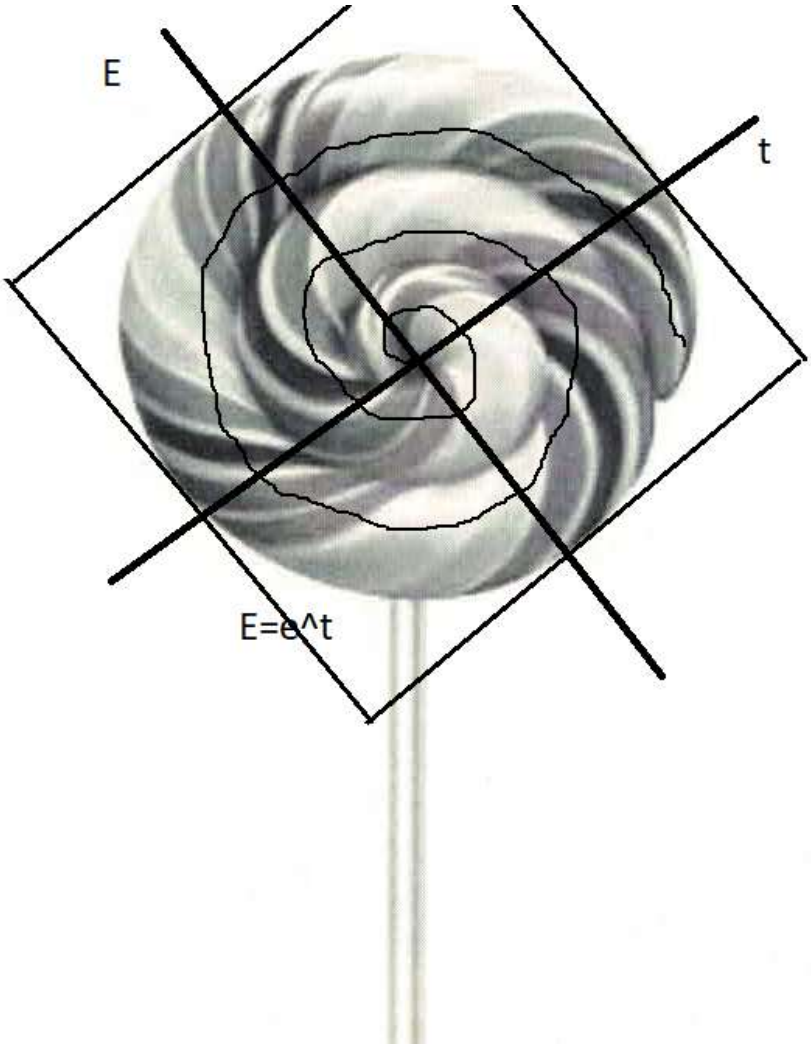

Figure 1 The lolly pop Source: O Toole, K., How to Cheat at French Verbs]

Circular Helix

$y=c=\sqrt{[a^2+b^2]}$

Set them equal:

$E=e^t=c^2=a^2+b^2$

$E=a^2+b^2=\sin 45°+\cos 45°=1/\sqrt{2}+1/\sqrt{2}=2/\sqrt{2}=\sqrt{2}$

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$\sin^2 45° + \cos^2 45° = 1^2$
$a^2+b^2=c^2=E \cdot t=E\ (1/E)=1$

$c=\sqrt{[a^2+b^2]}$ ⇒circular helix

Circular Helix

$x=a \cdot \cos t$
$y=\varepsilon \cdot a \cdot \sin t$
$z=bt$

Let $a=\varepsilon=b=1$

Let $t=45°=\pi/4$

$x=\cos \pi/4=1/\sqrt{2}$
$y=\sin \pi/4=1/\sqrt{2}$
$z=t=\pi/4$

$\pi/4 \Rightarrow x=y=1=E=t$

$c=\sqrt{[a^2+b^2]}=\sqrt{[1^2+1^2]}=\sqrt{2}=E=1/t=1/\sqrt{2}$

$z^2=a^2+b^2=2$
$z=\sqrt{2}=b\ (\pi/4)\pi=bt$

$4\sqrt{2}=b\pi$

$4\sqrt{2}/\pi=18.0=KE=t=\pi$ rads$=t_f$

$t=KE=1/2Mv^2$

$18=1/2\ M(\cos (45°))^2$

$M=72$ The 72 Rule

$72=9 \times 8=c^2 \cdot t=M$

$M=tc^2$

$E=e^t$
$E=e^0=1 \Rightarrow$Ln function

M=Ln t=1
t=0

$e^3=20.0$
t=3: $M=2=dM/dt=d^2E/dt^2$

$e^9=1/81=0.012345679=M$

$e^{81}=150.6\approx 3/2=1/G=1/E=1/M$

M=[1,2,1/81,3/2]

$t=[0,3,9,81]=[0,c,c^2,c^4]$

$M=tc^2$
$M[1/t]=c^2$
$ME=c^2$
$M=c^2/\sqrt{2}=9/\sqrt{2}=6.36396=1/0.157134=2/\pi$

$t=1/E=1/M=\pi/2=90°$

$M=tc^2=(\pi/2)(9)=\sqrt{2}=E=\sin 45°+\cos 45°$

$M=\overline{F}+\overline{P}$
M=Ma+Mv
$a+v=\sqrt{2}$

a=v

$2a=\sqrt{2}$
$s=\sqrt{2}/2=1/\sqrt{2}=v=a \Rightarrow y=y'$

$M=\overline{F}+\overline{P}$

$M=Ma+Mv$

$1=a+v$

$1=(1/\sqrt{2})^2+(1/\sqrt{2})^2$

$1=1/2+1/2$
$1=1$
true!

Conclusion

We ‘ve seen a proof for the Pareto Rule and we’ve seen why it applies to Cosmology.

REFERENCES

[1] O’Toole. K., How to Cheat at French Verbs. California: Give a Dog a Bone, 2019.