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Short Communication

Nonlinear Numbers to Public Debt Growth through Mathematical Induction

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Introduction

Just as an individual is expected to control his/her debt-to-asset ratio, so is a government expected to control its national debt as a function of the country's wealth, measured e.g. by its gross domestic product/GDP [1].

The study of the long-run relationship between public debt and growth relied upon heterogeneity across countries as well as under non-linear specifications [2].

Using total public debt data from 118 developing, emerging and advanced economies over the period 1960 to 2012 provides some evidence that countries with higher average debt-to-GDP ratios a more likely to see a negative effect on their long-run growth performance.

Underlying the static nonlinear model of empirical specification, herewith proposed mathematical induction on continuous nonlinear numbers to avoid the "chaos" of increasing debts.

Logarithmic *per capita* debt

The total current government debt $D(t)$ increases from last year's debt $D(t\text{-}1)$ partially due to interest payments on the debt $D(t\text{-}1)$ at interest rate $I_D(t)$, and partially because at the current primary deficit, defined as the difference between spending $S(t+1)$ and taxes $T(t+1)$. Thus,

$$D(t) = [1 + I_D(t-1)]\, D(t-1) + [S(t) - T(t)].$$

Supported by empirical facts, defined the annualized logarithmic growth rate of *per capita* initial debt $d_i(t)$:

$$\log [d_i(t + \Delta t)] = \alpha\Delta t + (1 - \beta\Delta t) \log (d_i(t))$$

Where β represents the "speed of convergence".

From a viewpoint of classifying the collection of continuous numbers into linear and nonlinear numbers. Linear numbers have no asymptote and nonlinear numbers are associated with one or two asymptotes.

Nonlinear numbers always have continuity and always preserve continuity – meaning they always have the next step or the next number, dynamic, non-terminating, and can never be forced to stop. It stated that the logarithmic scale is the standard scale for nonlinear numbers (Figure 1).

Convergence and mathematical induction

Nonlinear numbers as a group or series are adequate to

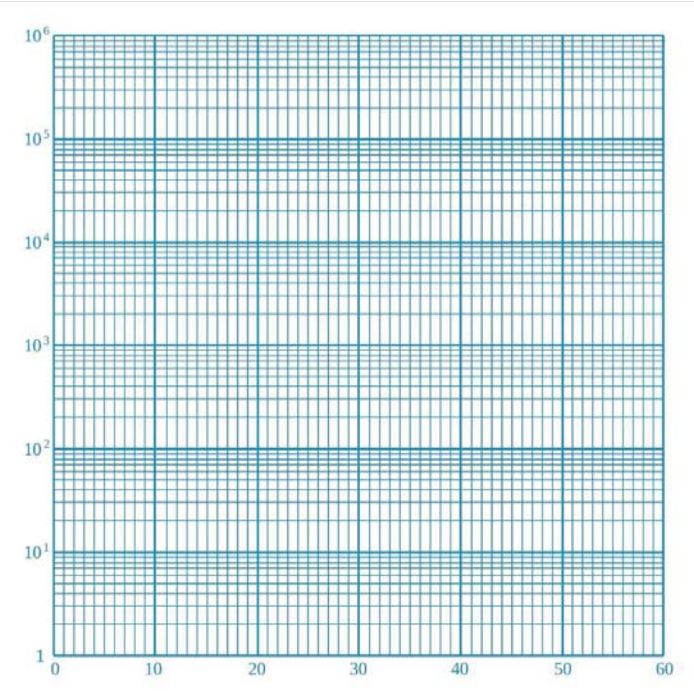

Figure 1

represent time used to describe the expression of logarithmic *per capita* debt and consist of real numbers, natural numbers, and integers.

On behalf of convergence of β, ever established of Cauchy Convergence Criterion: *A sequence of real numbers is convergent if and only if it is a Cauchy sequence.*

However, we note that if ε > 0 is given, then there is a natural number H = H(ε/2) belonging to the set $\{n_1, n_2, \ldots\}$ such that

$$| x_K - x^* | < \varepsilon/2$$

And if $n >= H(\varepsilon/2)$ since ε > 0 is arbitrary the sequence $X = (x_n)$ is convergent.

Further, we adopt The Principle of Mathematical Induction:

Let n be a natural number and let P_n be a statement that depends on n. If

i. P_1 is true, and

ii. For all positive integer k, P_{k+1} can be shown to be true if P_k is assumed to be true,

Then P_n is true for all natural numbers n.

An orthogonal system of fractal function is constructed explicitly for this space. Sufficient conditions for the uniform convergence of the fractal series expansion corresponding to this basis are also deduced [3].

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