Vector Theory (E3)

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Abstract
A general purpose platform for economic analyses.

Outline

Note

1. Infrastructure

Section 1: Composition

Let a factor be defined as a phenomenon with a set of quantitative attributes, a, such that

$$a_t = [a_{1t} \ldots a_{zt}] \qquad (1.1)$$

for i = 1 … z attributes at time t.

Let an index be defined as a function of a subset of the quantitative attributes of a factor, such that

$$b_t = f(\mathbf{a}_t) \qquad (1.2)$$

where $\mathbf{a}_t$ is a subset of a_t.

Let infrastructure be defined as a set of factors.

Section 2: Structure

Let ζ be the identifier of the ζth factor in an infrastructure, for $\zeta = 1 \ldots Z$ factors.

Let an array be defined as a function that describes the position of a factor with respect to a reference point.

Given an appropriate set of reference points, the arrays for a set of factors can be used to construct a map of an infrastructure.

2. Processes

Section 1: Composition

Let a reactant be defined as a factor that undergoes a set of transitions.
Let a regulator be defined as a factor that moderates a set of aspects of a set of transitions, but is not a reactant.
Let an input be defined as a reactant or regulator.

Let a product be defined as a factor that is formed by a set of transitions.
Let a residual be defined as a reactant that is intact after a set of transitions.
Let an output be defined as a product or residual.

Let a resource be defined as an input or output.

Let a process be defined as a set of transitions.

Section 2: Structure

Let γ be the identifier of the γth transition in a process, for $\gamma = 1 \ldots \Gamma$ transitions.

Let co(γ) be a progression to the γth transition in a process.
Let au(γ) be synchronization with the γth transition in a process.
Let fb(γ) be a regression to the γth transition in a process.

Let a process descriptor be defined as an expression of the structure of a process, such that

$$d = [1, \mathrm{co}(\gamma); \ldots \quad \Gamma, \mathrm{fb}(\gamma)] \tag{2.1}$$

Given the process descriptor for a process, a map of that process can be constructed.

3. Vectors

Section 1: Composition

Let a source be defined as a factor where a set of resources originates.
Let a field be defined as a factors where a set of resources is utilized.
Let a vector be defined as a set of sources and a subset of the corresponding set of fields.

Section 2: Structure

Let a vector descriptor be defined as an expression of the structure of a vector, such that

$$D = [(1,1),\ co(\gamma,\zeta);\ \ldots \quad (\Gamma,Z),\ fb(\gamma,\zeta)] \tag{3.1}$$

where ζ is the factor where the γth transition occurs, for $\zeta = 1 \ldots Z$ and $\gamma = 1 \ldots \Gamma$.

Given a set of vector descriptors, a sequence of maps of a vector can be constructed.

A1. Scale

Let α_t be defined as the 1 x A matrix of the set of inputs for a process, such that

$$\alpha_t = [\alpha_{1t} \ldots \alpha_{At}] \quad \text{(a1.1)}$$

Let δ_t be defined as the A x 1 matrix of indexes that corresponds to α_t.

Let β_{t+n} be the 1 x B matrix of outputs that corresponds to α_t, such that

$$\beta_{t+n} = [\beta_{1t+n} \ldots \beta_{Bt+n}] \quad \text{(a1.2)}$$

Let ε_{t+n} be defined as the B x 1 matrix of indexes that corresponds to β_{t+n}.

Let scale be defined as the relationship between a variable and the quantity of a resource.

Let input scale be defined as the relationship between α_t and δ_t, such that

$$\delta_t = f(\alpha_t) \quad \text{(a1.3)}$$

Let conversion scale be defined as the relationship between α_t and β_{t+n}, such that

$$\beta_{t+n} = g(\alpha_t, t, n) \quad \text{(a1.4)}$$

Let output scale be defined as the relationship between β_{t+n} and ε_{t+n}, such that

$$\varepsilon_{t+n} = h(\beta_{t+n}) \quad \text{(a1.5)}$$

A2. Flux

Let π_{t+n} be defined as the net result of a process, such that

$$\pi_{t+n} = \beta_{t+n}\varepsilon_{t+n} - \alpha_t\delta_t \qquad \text{(a2.1)}$$

Accounting for scale,

$$\pi_{t+n} = g(\alpha_t, t, n)h(\beta_{t+n}) - \alpha_t f(\alpha_t)$$
$$= g(\alpha_t, t, n)h(g(\alpha_t, t, n)) - \alpha_t f(\alpha_t) \qquad \text{(a2.2)}$$

Let flux be defined as the relationship between π_{t+n} and a variable.

Let alpha-flux be defined as the relationship between π_t and α_t, such that

$$d\pi_t/d\alpha_t = g'(\alpha_t, t, n)h(g'(\alpha_t, t, n)) - f'(\alpha_t) \qquad \text{(a2.3)}$$

Let delta-flux be defined as the relationship between π_{t+n} and δ_t, such that

$$d\pi_t/d\delta_t = - \alpha_t \qquad \text{(a2.4)}$$

Let beta-flux be defined as the relationship between π_t and β_{t+n}, such that

$$d\pi_t/d\beta_{t+n} = \varepsilon_t \qquad \text{(a2.5)}$$

Let epsilon-flux be defined as the relationship between π_t and ε_{t+n}, such that

$$d\pi_t/d\varepsilon_{t+n} = \beta_{t+n} \qquad \text{(a2.6)}$$

B1: Equivalence

Principle of Equivalence:
the classification of a factor in a process is determined by the vector the process is categorized in.

Let π_{st+n} be defined as the standard form of π for a process with respect to a given vector, such that

$$\pi_{st+n} = \beta_{t+n}\varepsilon_{t+n} - \alpha_t\delta_t \qquad \text{(b1.1)}$$

Let π_{rt+n} be defined as the reverse form of π_{st+n}, such that

$$\pi_{rt+n} = \alpha_t\delta_t - \beta_{t+n}\varepsilon_{t+n} \qquad \text{(b1.2)}$$

Given these definitions,

$$\pi_{st+n} = -\pi_{rt+n} \qquad \text{(b1.3)}$$

or

$$\pi_{st+n} + \pi_{rt+n} = 0 \qquad \text{(b1.4)}$$

B2: Conservation

Principle of Conservation:
for any given process, all of the factors in a set of inputs must be accounted for in the set of outputs, and the set of inputs must account for the set of outputs.

Given this definition,

$$\pi_{t+n} = 0 \qquad \text{(b2.1)}$$

for all processes.

If selected inputs or outputs are excluded from the calculation of π, then π can have a nonzero value.

Let $\mathit{\pi}_{t+n}$ be defined as a modified form of π_{t+n} where a subset of inputs is excluded from α_t.

Let $\mathbf{\pi}_{t+n}$ be defined as a modified form of π_{t+n} where a subset of outputs is excluded from β_{t+n}.

Let $\boldsymbol{\pi}_{t+n}$ be defined as a modified form of π_{t+n} where a subset of inputs and outputs are excluded from α_t and β_{t+n}, respectively.