Economic Analysis Supplemental

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Abstract

An extension of several topics presented in *Economic Analysis (3rd Edition)*.

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First Order Dynamics: Valuation

Where more than one currency exists, let rx be the conversion ratio, such that

$$rx = cy / cx \qquad (1.1)$$

where cx is a given quantity of currency x, and cy is the quantity of currency y that can be obtained with cx.

Where currency can be transferred between periods of time, let

$$FV_{t+n} = \rho_t (1 + r)^n \qquad (1.2)$$

where ρ_t is a given quantity of currency at time t, n is the number of temporal conversions, r is the average inter-temporal conversion ratio, and FV_{t+n} is the value of ρ_t at time $t+n$.

Similarly, let

$$PV_t = \rho_{t+n} (1 + r)^{-n} \qquad (1.3)$$

where ρ_{t+n} is a given quantity of currency at time $t+n$, and PV_t is the value of ρ_{t+n} at time t.

Where goods can be utilized by multiple agents simultaneously, let rm be the multiplication ratio, such that

$$rm = c_{1E} / b_{1E} \qquad (1.4)$$

Where a given percentage of a set of goods is reserved and not available for simultaneous use,

$$0 \leq rm \leq rr \qquad (1.5)$$

where rr is the reserved ratio.

Second-Order Dynamics: Selection

Section 1: Resolution

Where the set of processes a set of agents can execute at a point in time is a subset of the set of processes it is capable of executing, production and consumption are determined by the set's valuation of the available processes.

After conducting any necessary conversions, the profit of the available processes can be ranked such that

$$\pi_{1t} \geq \ldots \geq \pi_{nt} \quad (1.1)$$

for 1...*n* processes.

Where the ranking does not eliminate a sufficient number of processes for consideration, additional third-order constraints can be introduced to the calculations to resolve the ambiguity.

Given a resolved set of processes, a set of agents will execute the first 1...*k* processes, where $k < n$.

Section 2: Adaptation

Let $rk_{\gamma t}$ be the relative ranking of the γ^{th} process at time *t*, such that

$$rk_{\gamma t} = \pi_{\gamma t} / \pi_{St} \quad (2.1)$$

where $\pi_{\gamma t}$ is the profit associated with the γ^{th} process at time *t*, and π_{St} is sum of the profits associated with all γ processes, for $\gamma = 1 \ldots \Gamma$.

Let $\mathrm{ad}(\gamma)_t$ be the change in the process rankings for a given set of agents at time *t*, such that

$$\mathrm{ad}(\gamma)_t = RK_t - RK_{t-n} \quad (2.2)$$

where RK_t is a matrix of process rankings for processes available at time *t*, and RK_{t-n} is a matrix of process rankings for processes available at time *t*.

Where there are *x* processes in RK_t not in RK_{t-n} and *y* processes in RK_{t-n} not in Rk_t, RK_t and RK_{t-n} are 1 x $(x+y+z)$ matrices, where there are *z* common processes.

Third-Order Dynamics: Integration

Section 1: Trade

Let opportunity cost be defined as the profit a set of agents forfeits by executing a given set of processes.

Where a set of agents can execute exchanges with an exogenous set of agents, acquisition of a set of goods, $\boldsymbol{n}$, is profitable relative to endogenous acquisition if

$$\boldsymbol{Cn} < \boldsymbol{Cp} \tag{1.1}$$

where $\boldsymbol{Cn}$ is the cost of acquiring $\boldsymbol{n}$ from exogenous agents, and $\boldsymbol{Cp}$ is the opportunity cost of producing $\boldsymbol{n}$.

Similarly, distribution of a set of goods, $\boldsymbol{N}$, is profitable relative to endogenous distribution if

$$\boldsymbol{RN} > \boldsymbol{Cp} \tag{1.2}$$

where $\boldsymbol{RN}$ is the revenue from distributing $\boldsymbol{N}$ to exogenous agents.

Section 2: Valences

Let XV_t be the export valence of an exchange network at time t, such that

$$XV_t = XI / I \tag{2.1}$$

where XI is the set of goods that can be distributed to a given exogenous exchange network while satisfying (1.2).

Let MV_t be the import valence of an exchange network at time t, such that

$$MV_t = MR / R \tag{2.2}$$

where MR is the set of goods that can be acquired from a given exogenous exchange network while satisfying (1.1).

Section 3: Trade Accounts

Let b_{xt} be the set of goods exported by the agents in an exchange network, and let c_{mt} be the set of goods imported, at time t. Using these definitions, let XM_t be the current account balance at time t, such that

$$XM_t = b_{xt}Y_{xt} - c_{mt}Z_{mt} \tag{3.1}$$

where x denotes export and m denotes import.

Let b_{dt} be the set of endogenously owned exogenous vertices and let c_{ft} be the set of exogenously owned endogenous vertices. Using these definitions, let CA_t be the capital account balance at time t, such that

$$CA_t = b_{dt}Y_{dt} - c_{ft}Z_{ft} \tag{3.2}$$

where d denotes endogenity and f denotes exogeneity.