

Modeling Dynamic Supply Chains with Endogenous Allocations and Market Clearing

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SUMMARY

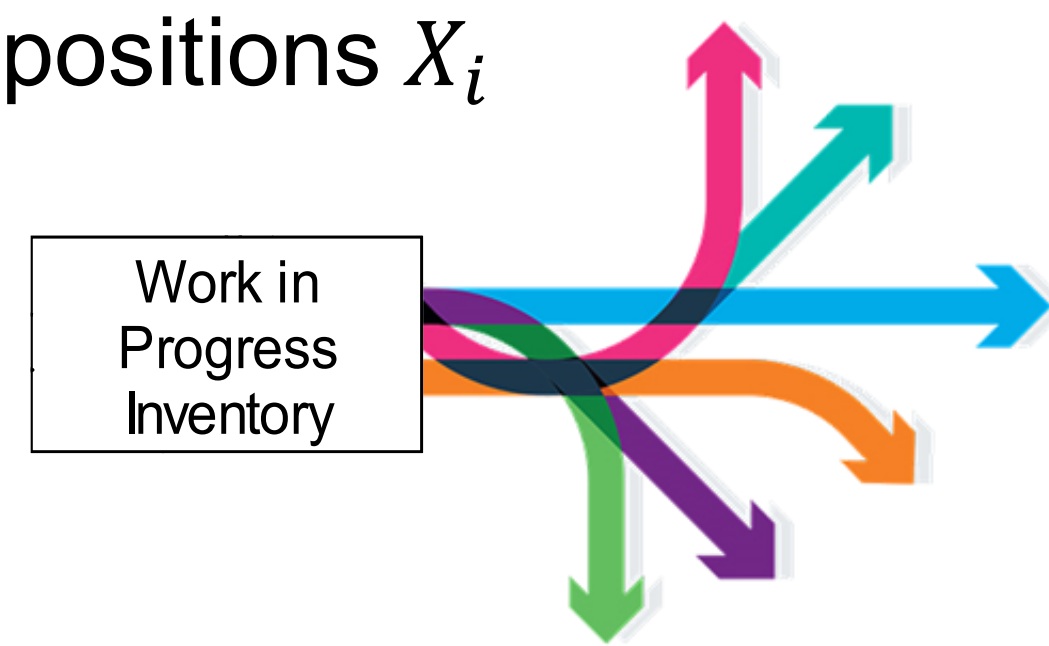
- This work is a **methodological contribution** for incorporating **choice** and **economic feasibility** into WIP disposition decisions in **supply chain models**

BACKGROUND

- Classical models of Supply Chains often treat **Work in Progress (WIP)** as a fixed-delay state
- WIP is not Guaranteed nor Free** with possibility for lines losses, spoilage, tied up operational capacity, and tied up cash (both now and later!)
- The producer has a **choice** about disposition of goods in WIP state, when or if to move goods through WIP state, with economic consequences

LOGISTIC CHOICE MODEL

- For a single producer with a single good, each disposition route decision is binary and non-overlapping
- For an **aggregate model** of many producers and/or goods can use **economic-based logistic choice model** to estimate net flows of dispositions X_i

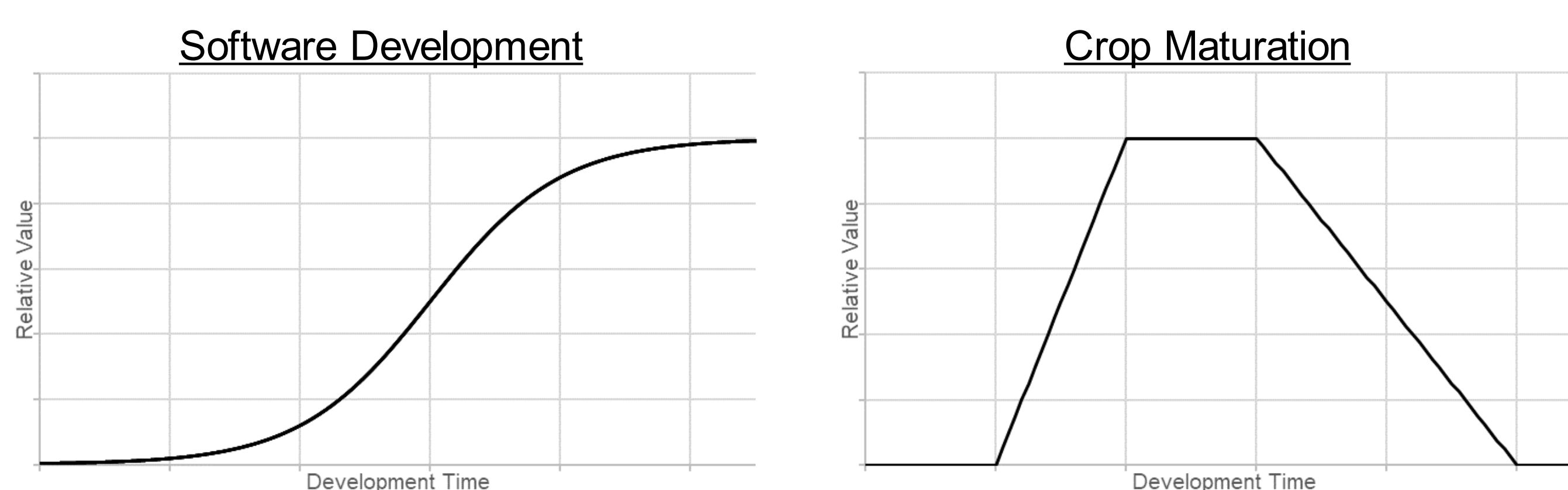


$$P(X_i) = \frac{e^{\beta\pi_i}}{\sum_{i=1}^N e^{\beta\pi_i}}$$

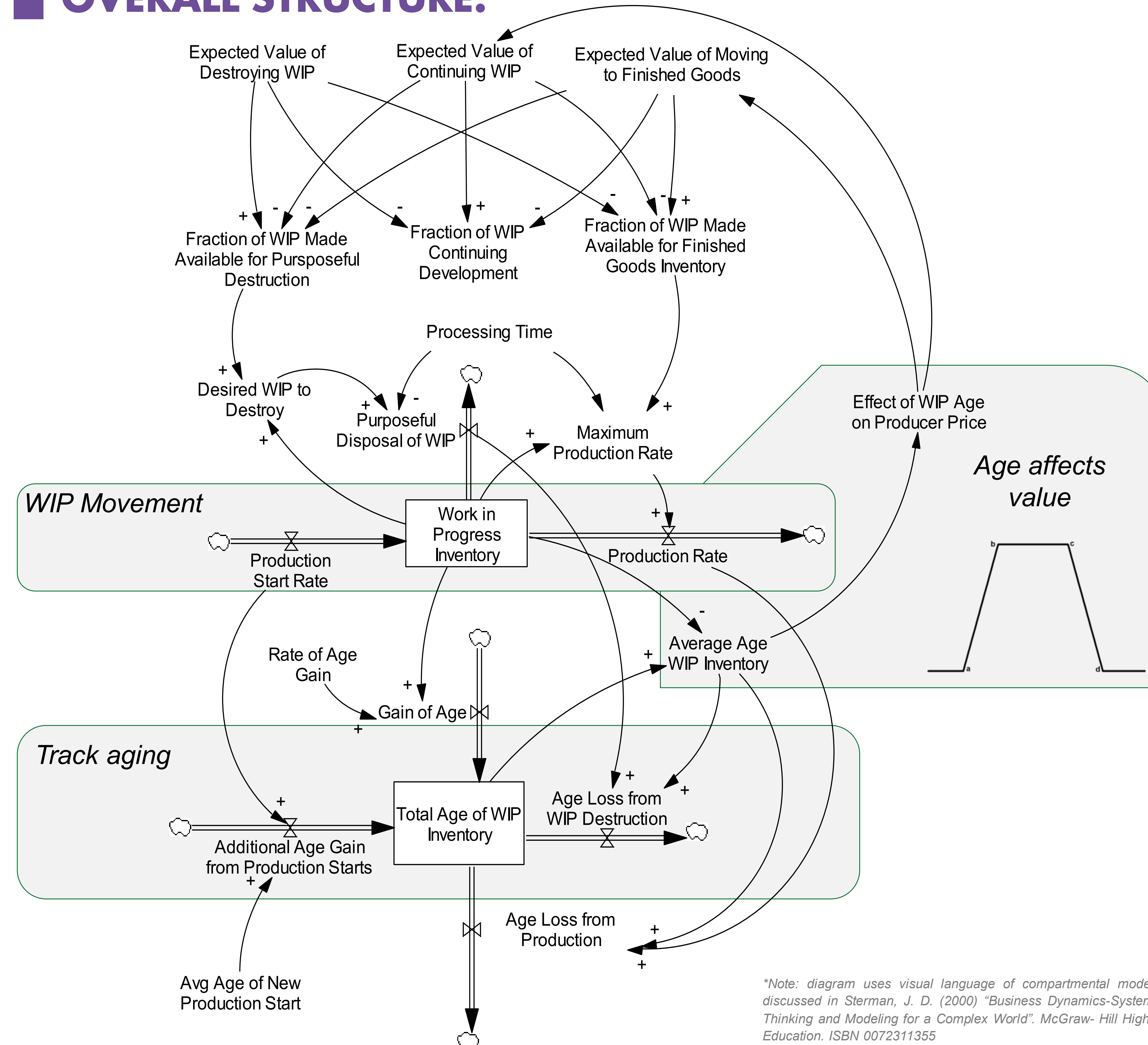
where $\beta_i = \frac{1}{\text{reference price}} \forall i$

ECONOMIC VALUATION & MARKET CLEARING

- Prices for fully matured goods can be determined by classical market clearing mechanisms
- Fixed-delay WIP supply chain models capture an 'ideal' development time implicitly
- Realized prices are determined by incorporating a relationship between WIP development time and underlying economic value
- Context-dependent shapes possible:

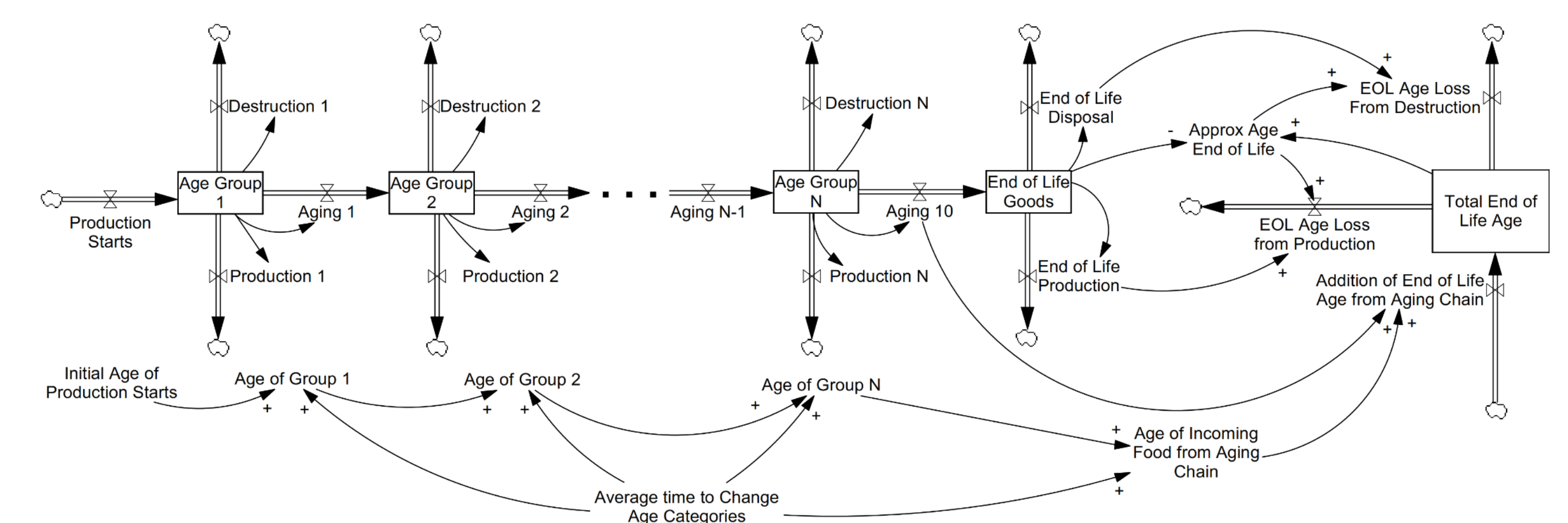
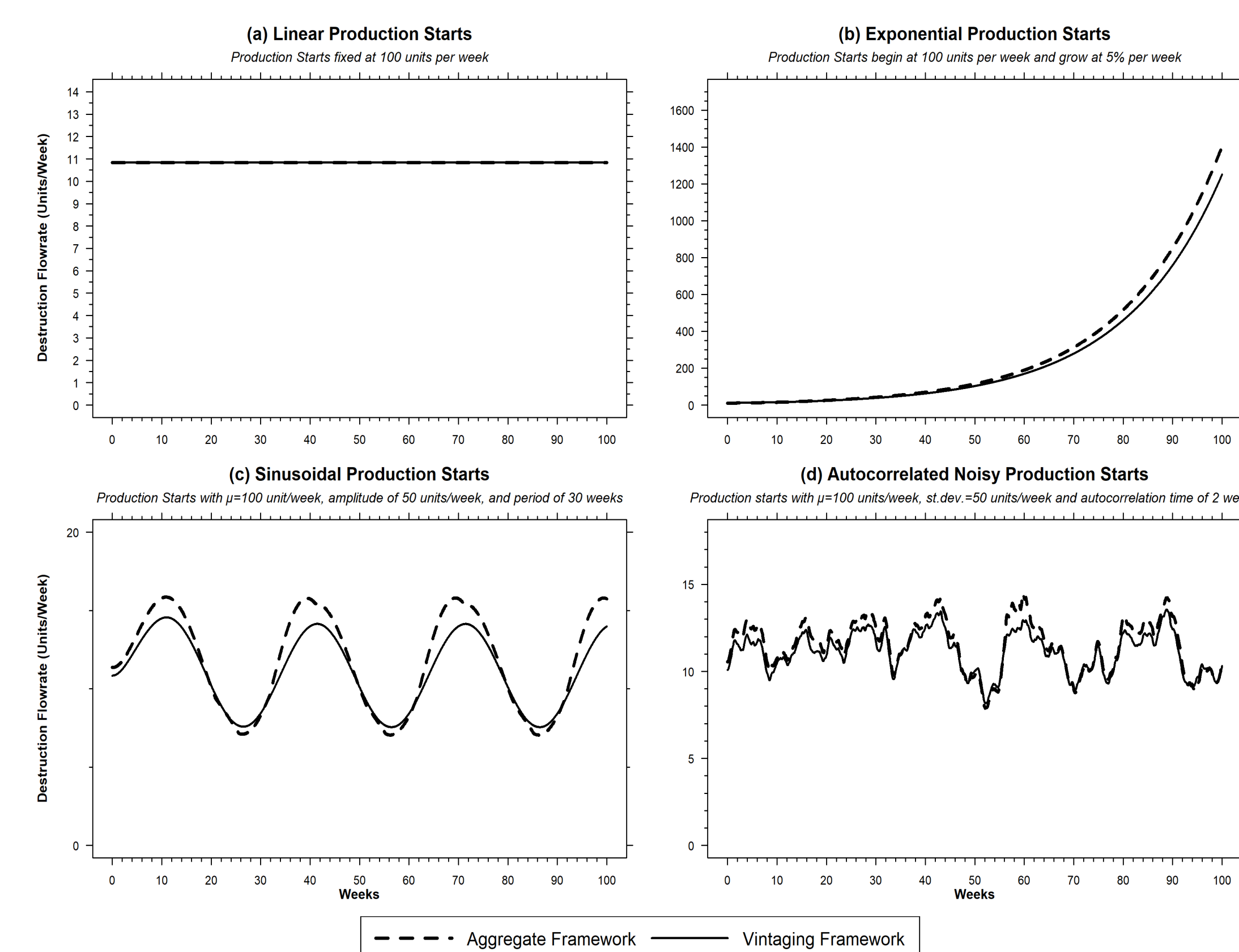


OVERALL STRUCTURE:



- WIP is continued to be developed only if it is economically viable to do so
- Probability of each disposition route is determined by expected value of each choice, affected by:
 - Current market clearing prices of fully developed goods
 - Age-value relationship of WIP under development
 - Any other costs or revenues expected from each disposition option
- Goods may sit in WIP state *longer* than ideal if that is (or is perceived to be) economically advantageous
- Useful for any context in which full development of WIP goods is not guaranteed

EXPLODING INTO SUBPROCESSES



- Global age-value relationship can be applied across vintaging chain
- Can provide additional insights (at the cost of additional complexity and model parameterization)
- Equivalent vintaging and aggregate chains can be constructed, diverging when 'matched' under one production pattern but applied to a different pattern
- Ultimately, choose framework that is behaviorally and operationally realistic for the context.