

The **F**orest **A**gent-**B**ased **L**andowner **E**conomy (FABLE)

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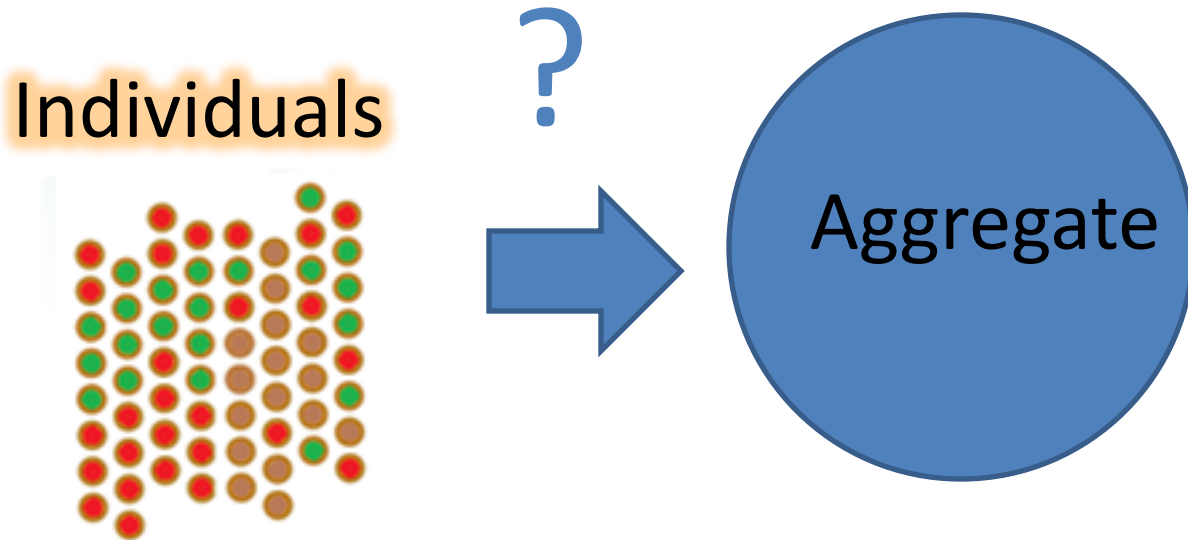
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Two themes in the literature

1. Forest landowner decisions – (how to determine optimal time to harvest given what a landowner values)
2. Aggregate market behavior – (characteristics of those that harvest, supply elasticity, total harvests, price changes)

Problem: what is the connection?



Literature: forest landowner decisions

- ❖ Classical Faustmann – cut at a certain age
- ❖ Hartman – value on standing forest¹
- ❖ Reservation price – “the price is right”²
- ❖ Landowner demographics/preferences³
- ❖ Decisions with uncertain prices/risk⁴

¹ (Hartman, 1976)

² (McGough, Plantinga, & Provencher, 2004)

³ (Amacher, Conway, & Sullivan, 2003) (Binkley, 1981)

⁴ (Norstrom, 1975) (Routledge, 1980) (Koskela, 1989)
(Pukkala & Kanga, 1996) (Zhang, 2001)

Literature: landowner heterogeneity

SURVEYS & CLUSTER ANALYSES

- Timber, Multiobjective, Nontimber¹ (National Woodland Owner Survey)
- Thoreau, Muir, Jane Doe³
- “Multiobjective, Recreationists, Self-employed owners, Investors, and Indifferent owners”⁴

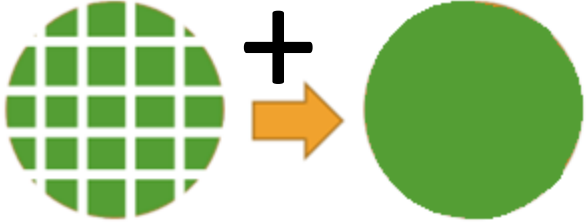
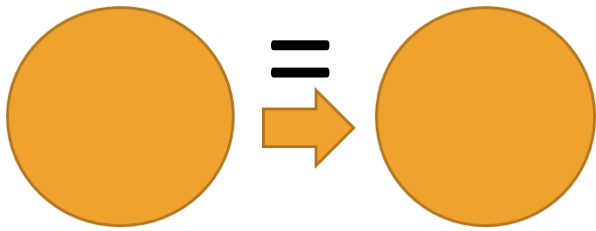
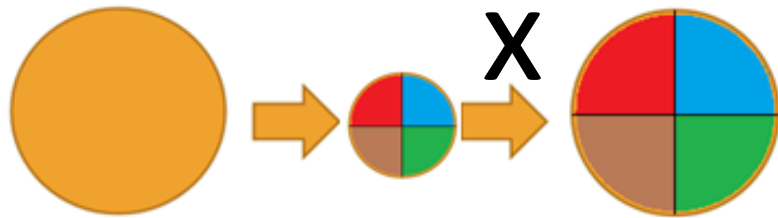
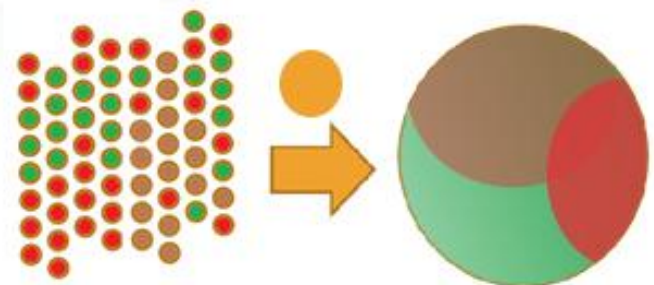
→ Representing landowner behavior by group or type (with variation) might better describe the situation.

¹ (Majumdar, Teeter, & Butler, 2008)

² (Finley & Kittredge, 2006)

³ (Favada, Karppinen, Kuuluvainen, Mikkola, & Stavness, 2009)

Literature: aggregating individuals

1. “Engineering” models 
2. Econometric models¹ 
3. Probit models² 
4. Agent-based models 

¹ (Wear & Parks, 1994)

² (Prestemon & Wear, 2000)

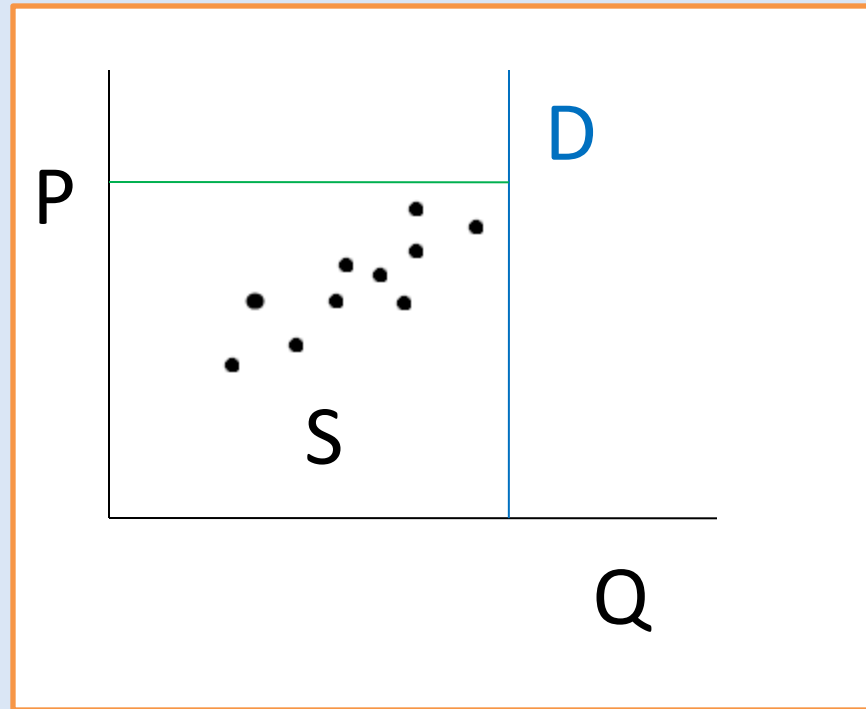
Literature: agent-based modeling

- Features of agent-based modeling (Gilbert, 2006)
 - A **computational** method
 - **Heterogeneous** agents
 - Representation of an environment
 - Agent Interactions
 - Bounded rationality
 - Learning
- Previous applications
 - Forest Economics: W. Canada, pine beetle risk (Schwab et al., 2009)
 - Environ. Sci.: Harvesting/ecosystem services (Satake et al 2007)
 - Artificial Markets (Schredelseker & Hauser, 2008)

Objectives - FABLE

- Develop an agent-based timber market model which simulates inventory, removals and prices which emerge from heterogeneous agents.
- Determine the market features that result from each of five cases.
- Determine the supply response to different levels of demand and the implications for sustainability.

Methods: bidding



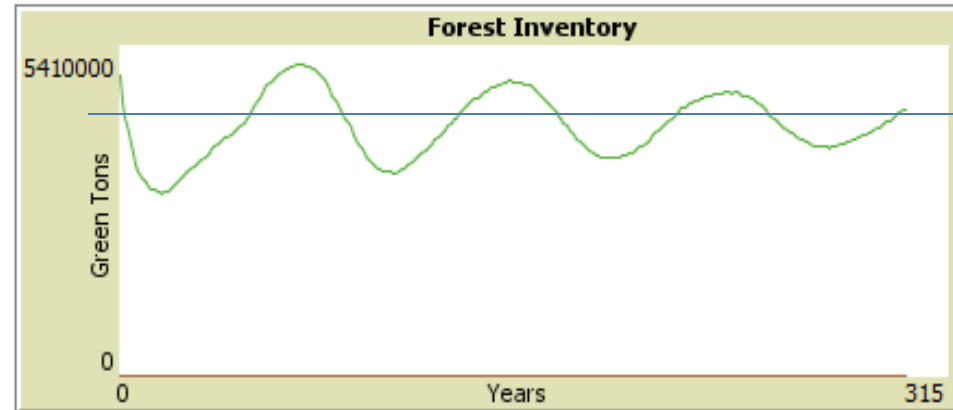
Bid heterogeneity from:

1. Heterogenous discount rates
2. Heterogeneous stand ages

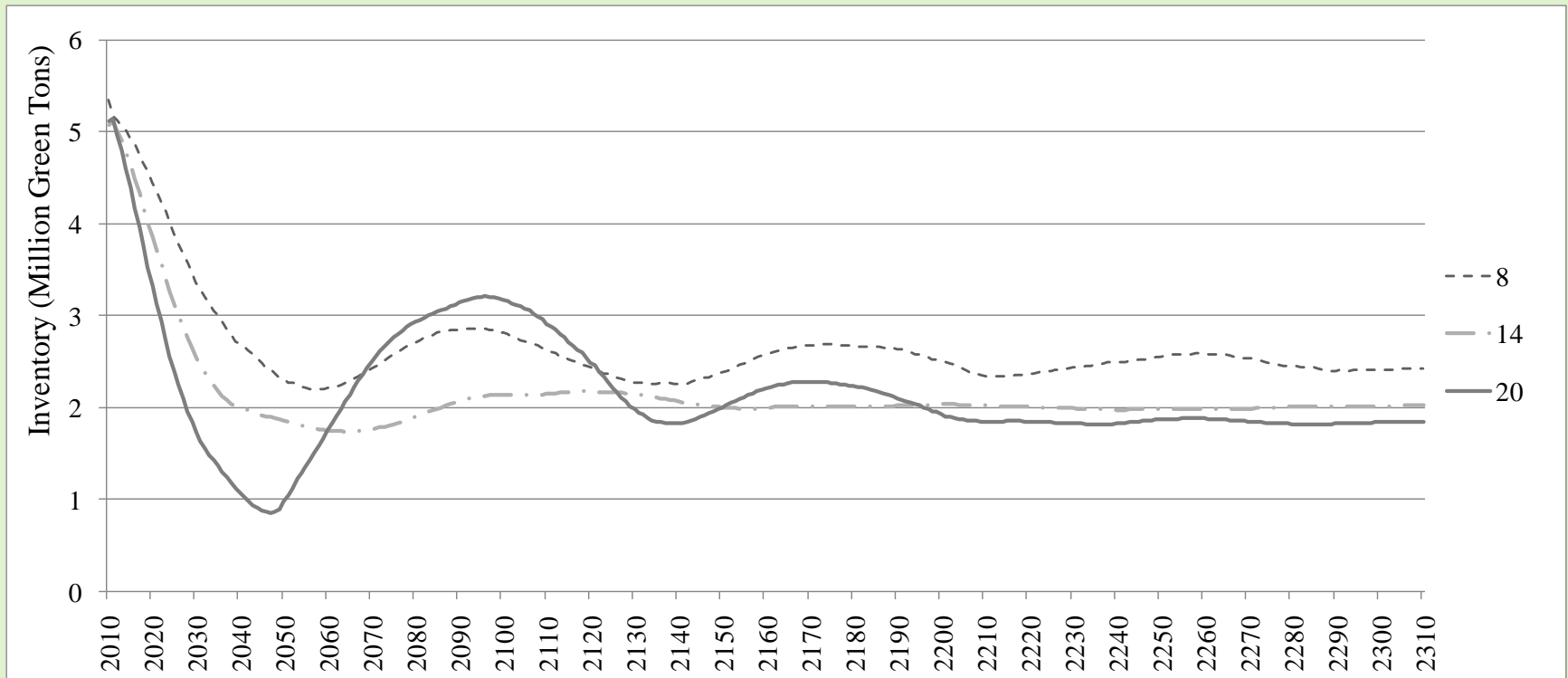
Methods: outputs of the model

- supply elasticity
- sustainability index
- price
- average harvest age
- removals
- demand
- inventory

$$E_s = \frac{Q_{j+1} - Q_j}{Q_j} \cdot \frac{P_{j+1}}{P_{j+2} - P_{j+1}}$$

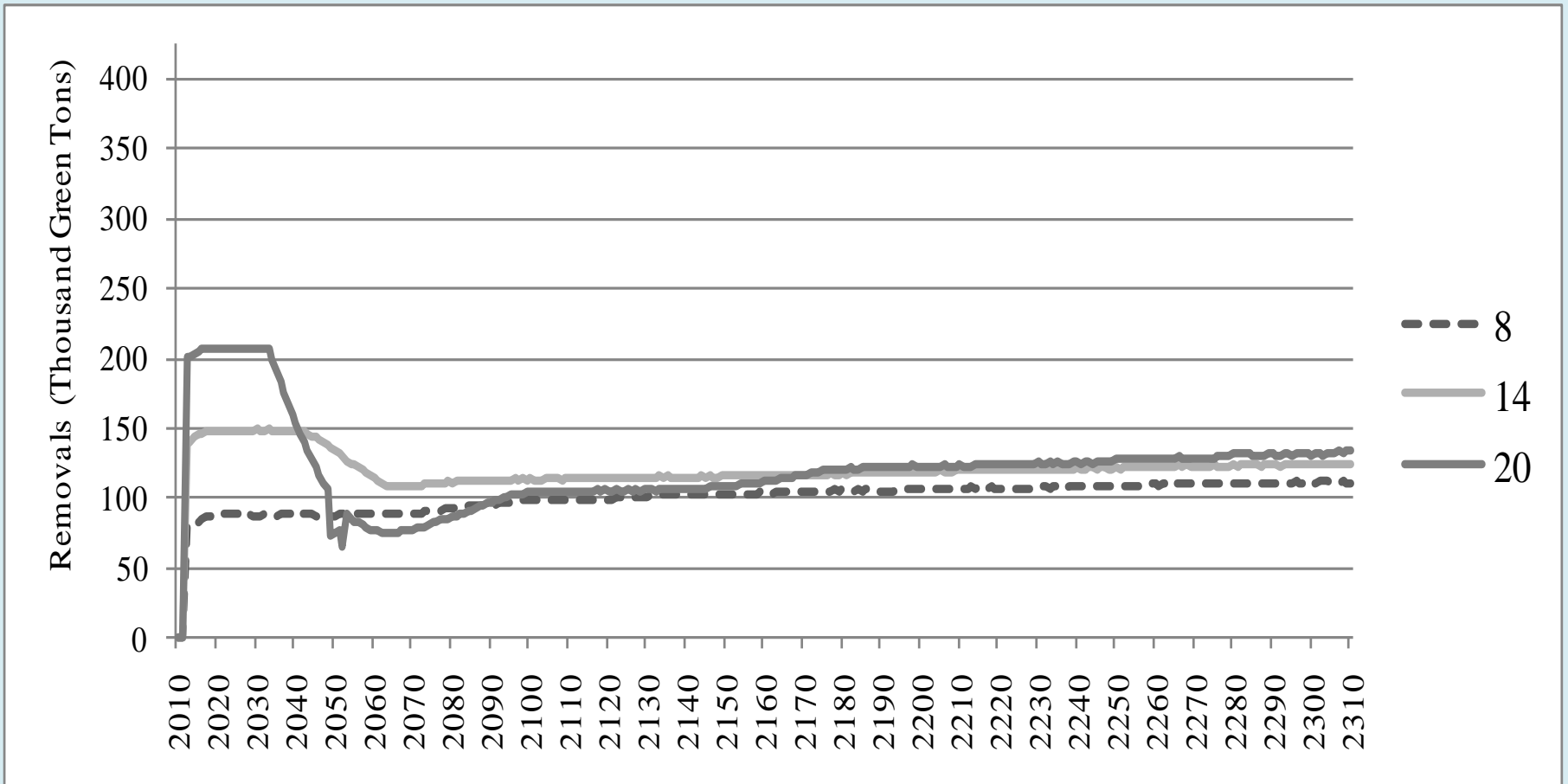


66% Reservation Price Faustmann: inventory



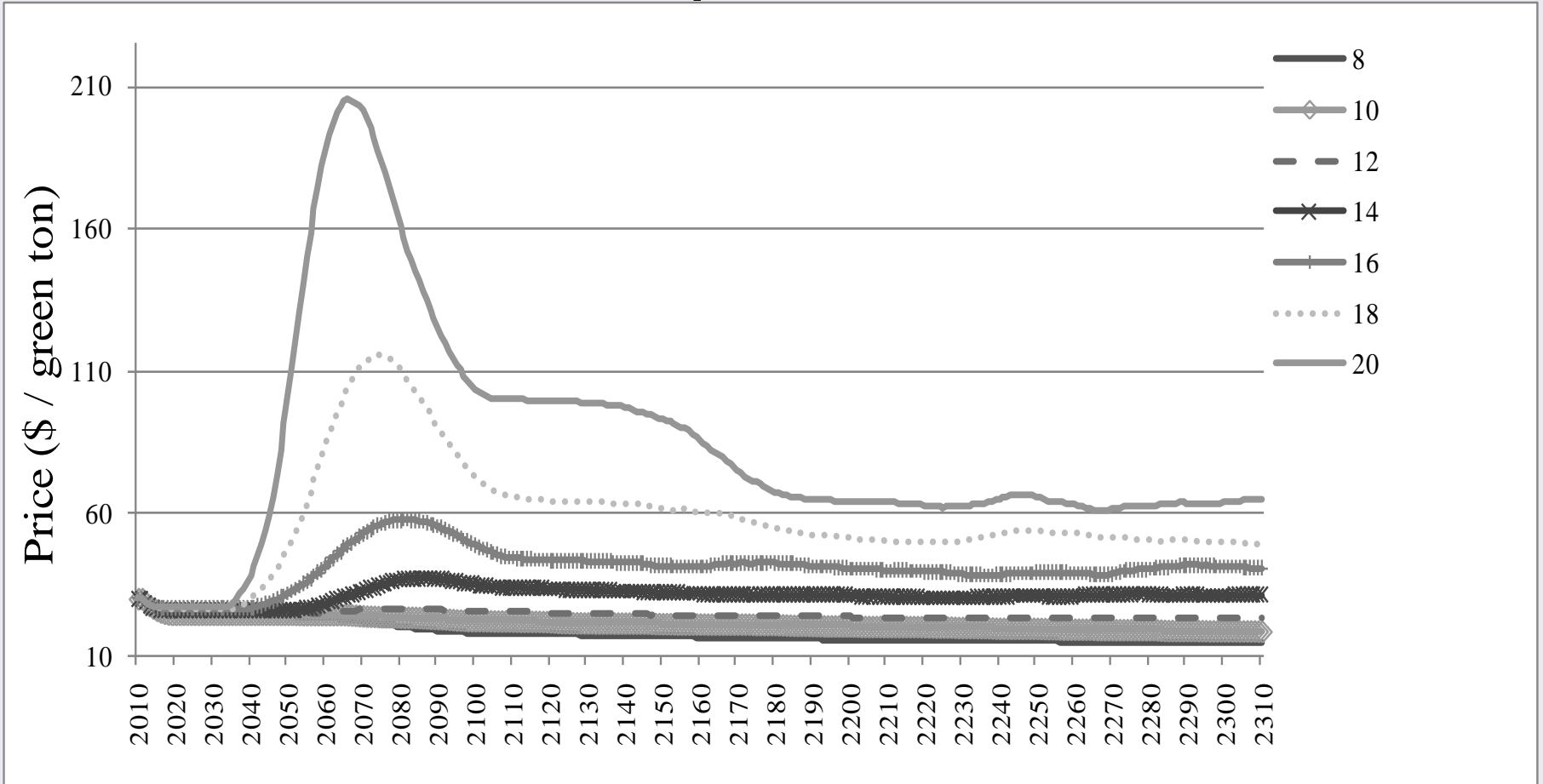
Inventory for reservation price Faustmann (66%) and reservation price Hartman (34%) by demand level

66% Reservation Price Faustmann: removals \approx demand



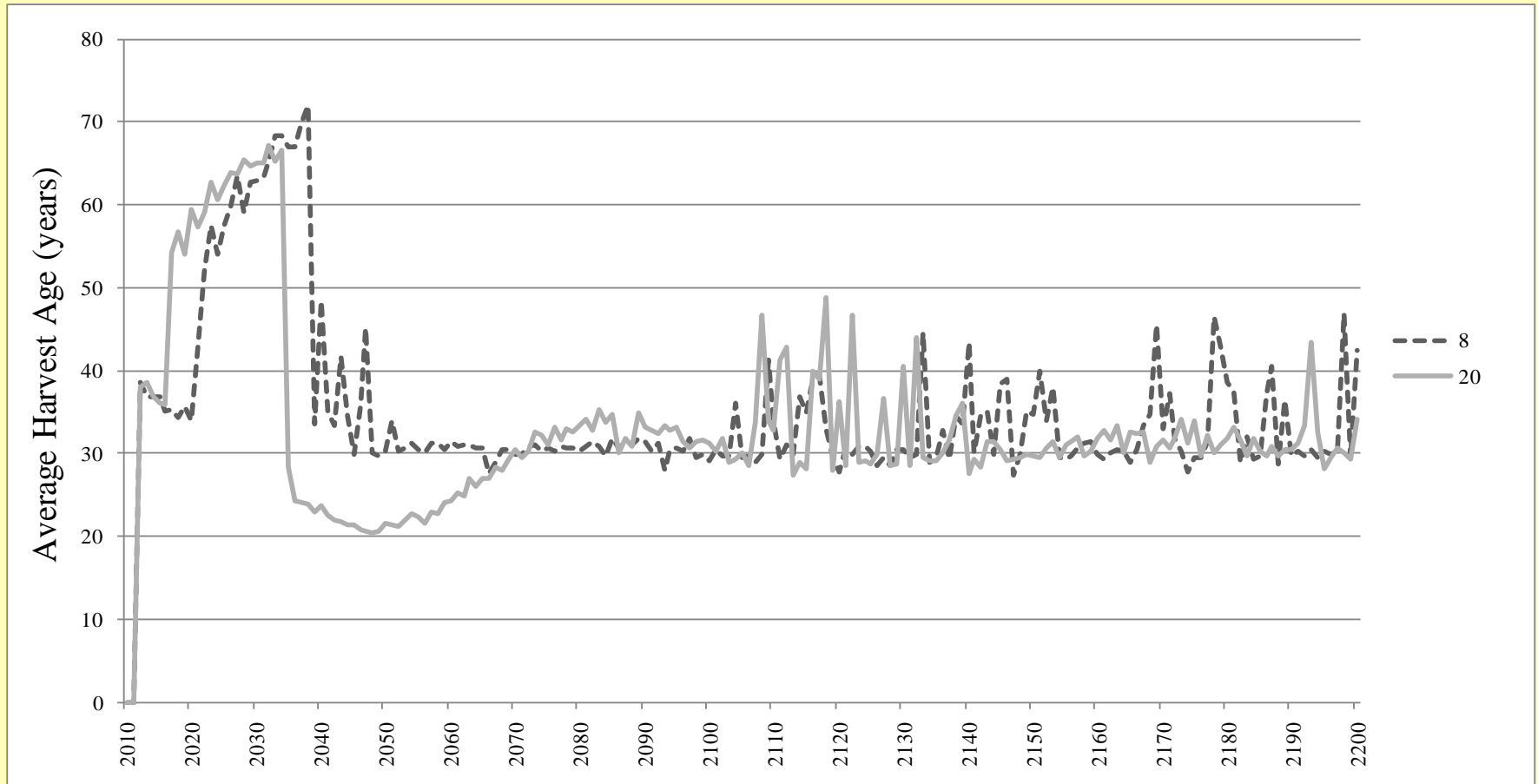
Removals for reservation price Faustmann (66%) and reservation price Hartman (34%) by demand level

66% Reservation Price Faustmann: price



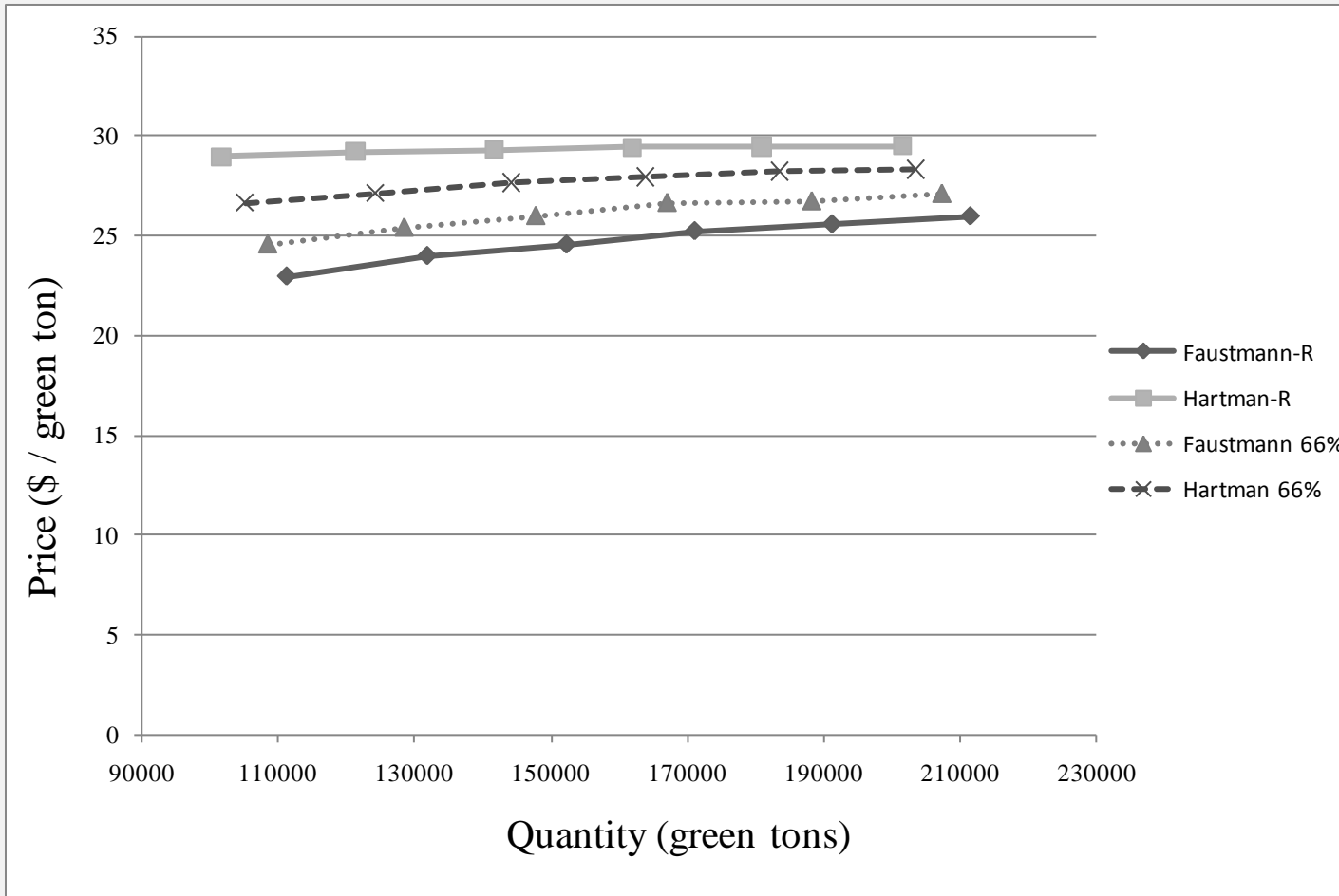
Price for reservation price Faustmann (66%) and reservation price Hartman (34%) by demand level

66% Reservation Price Faustmann: average harvest age



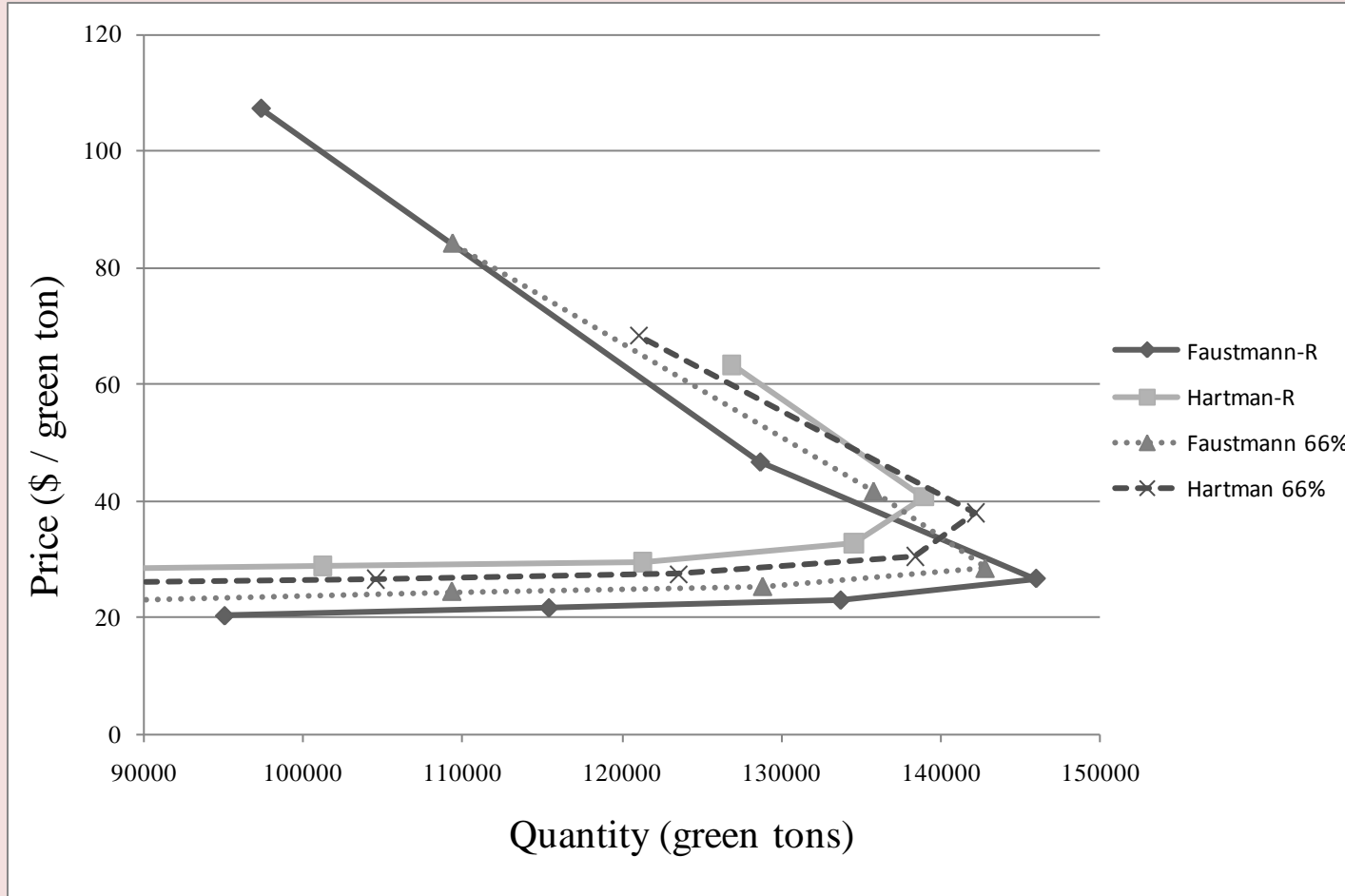
Harvest age for reservation price Faustmann (66%) and reservation price Hartman (34%) by demand level

Results/Conclusion: supply curves



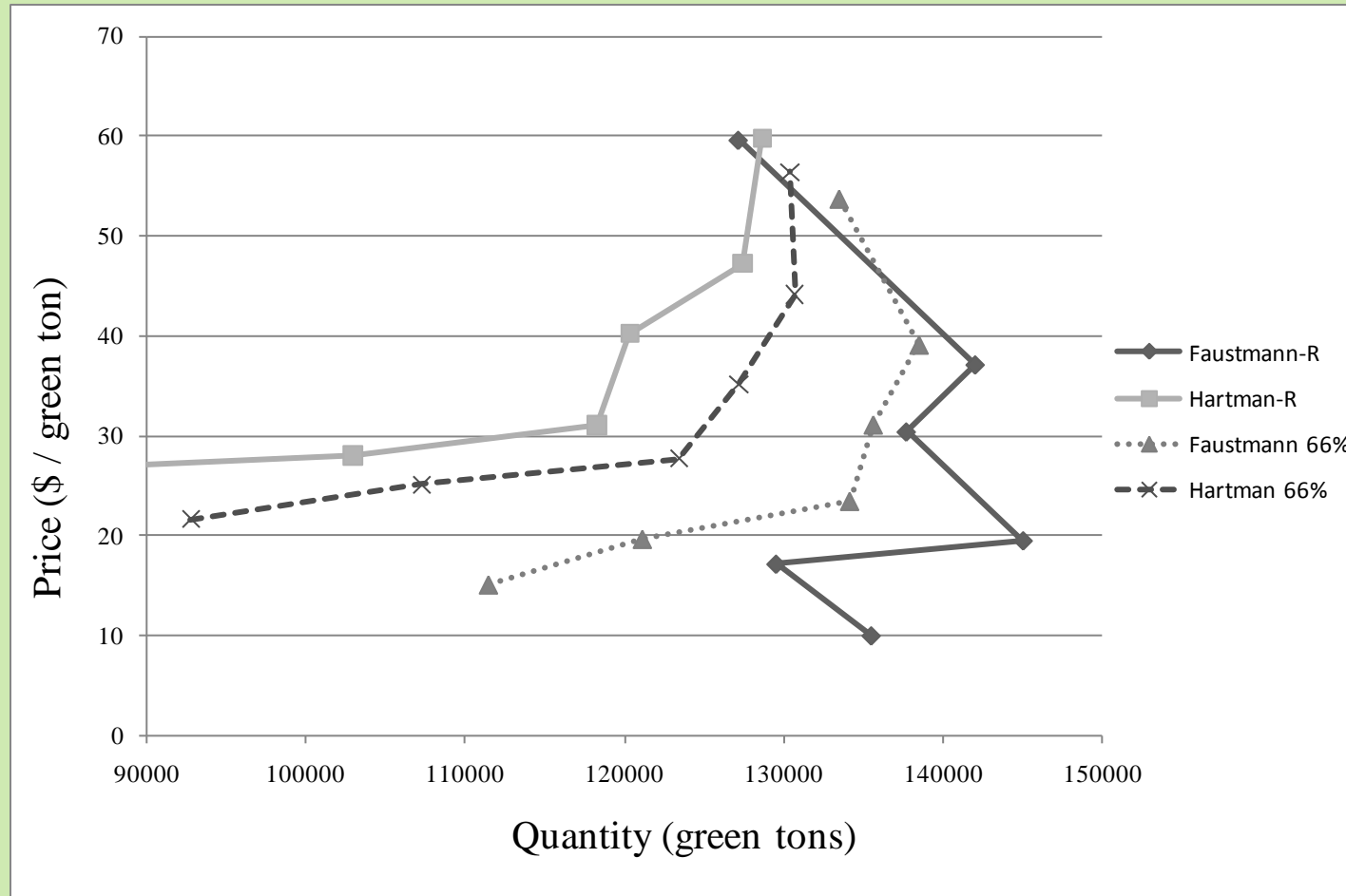
Supply curves for four cases in the year 2020

Results/Conclusion: supply curves



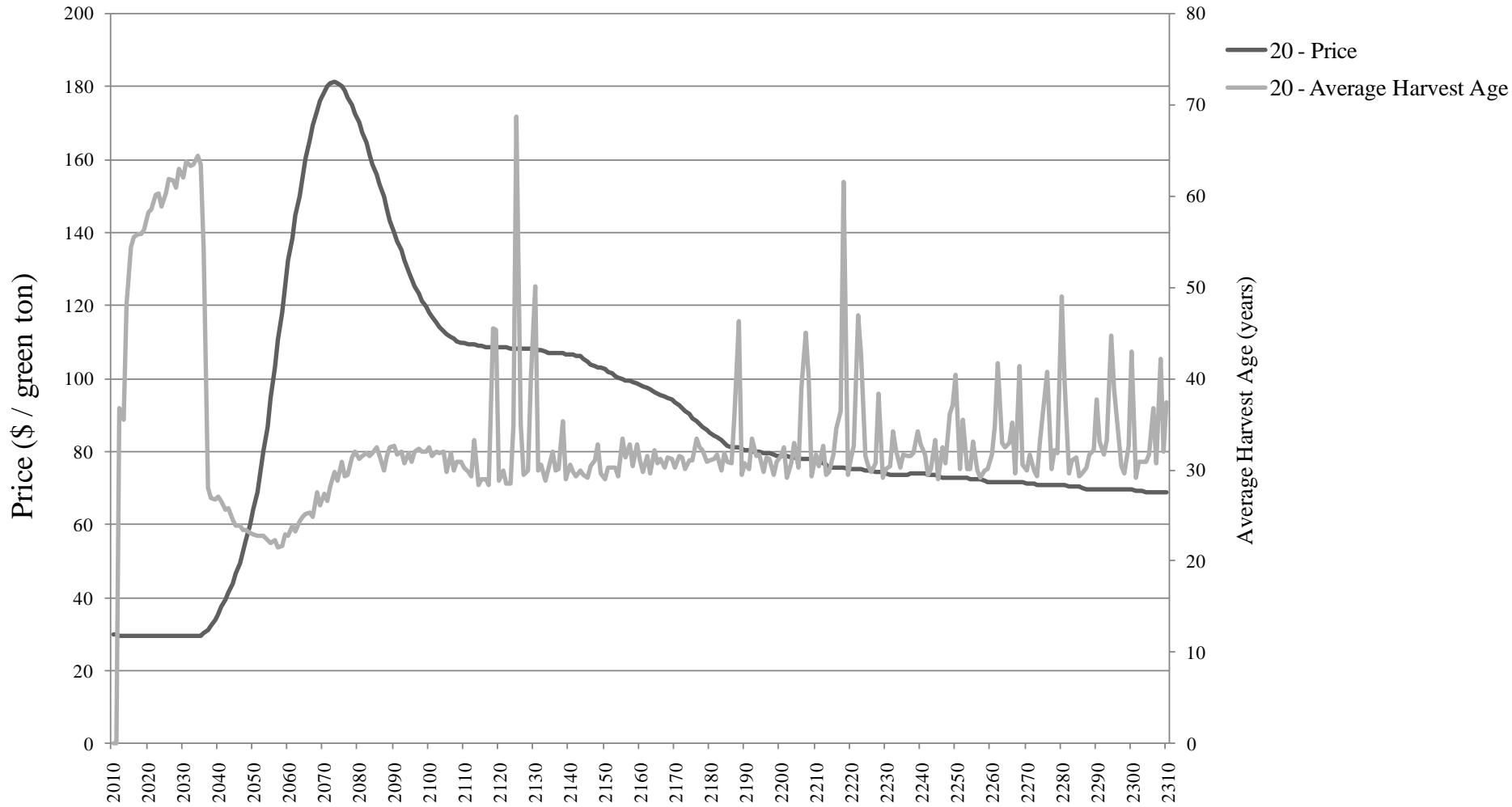
Supply curves for four cases in the year 2060

Results/Conclusion: supply curves

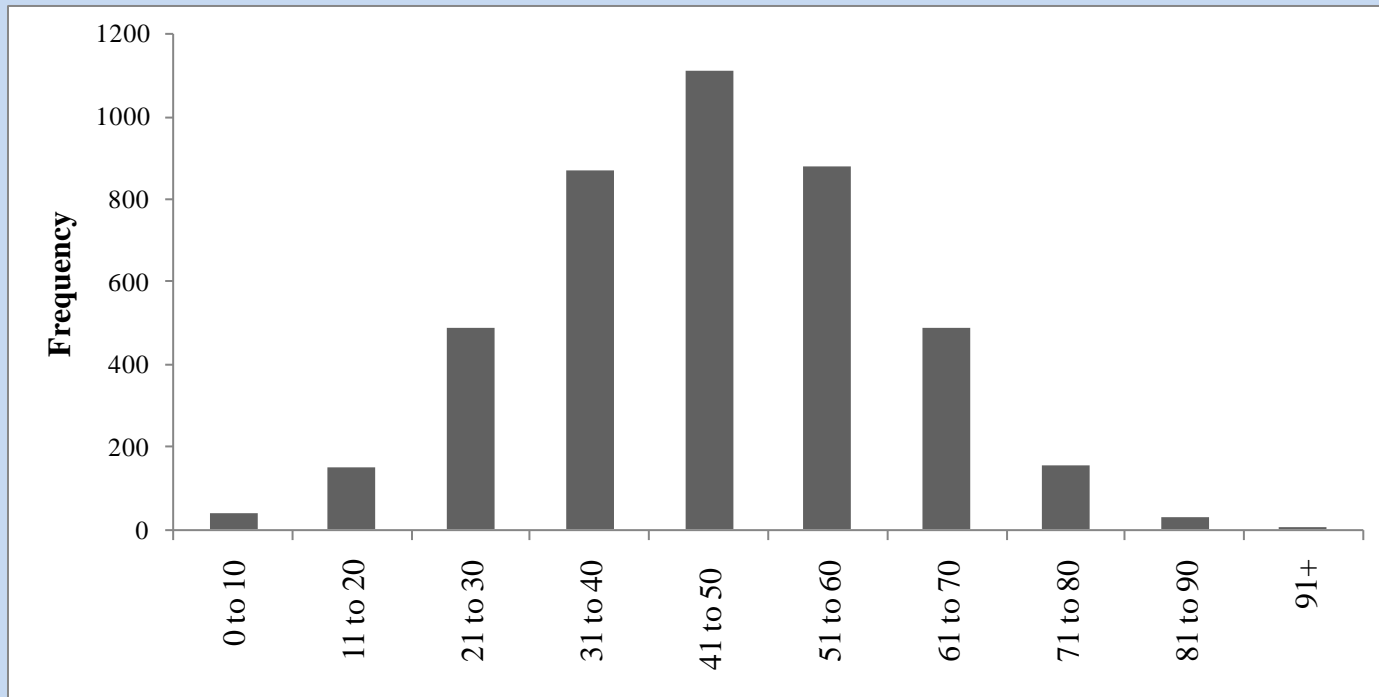


Supply curves for four cases in the year 2250

Results/Conclusion: Harvest age and Price Bubbles

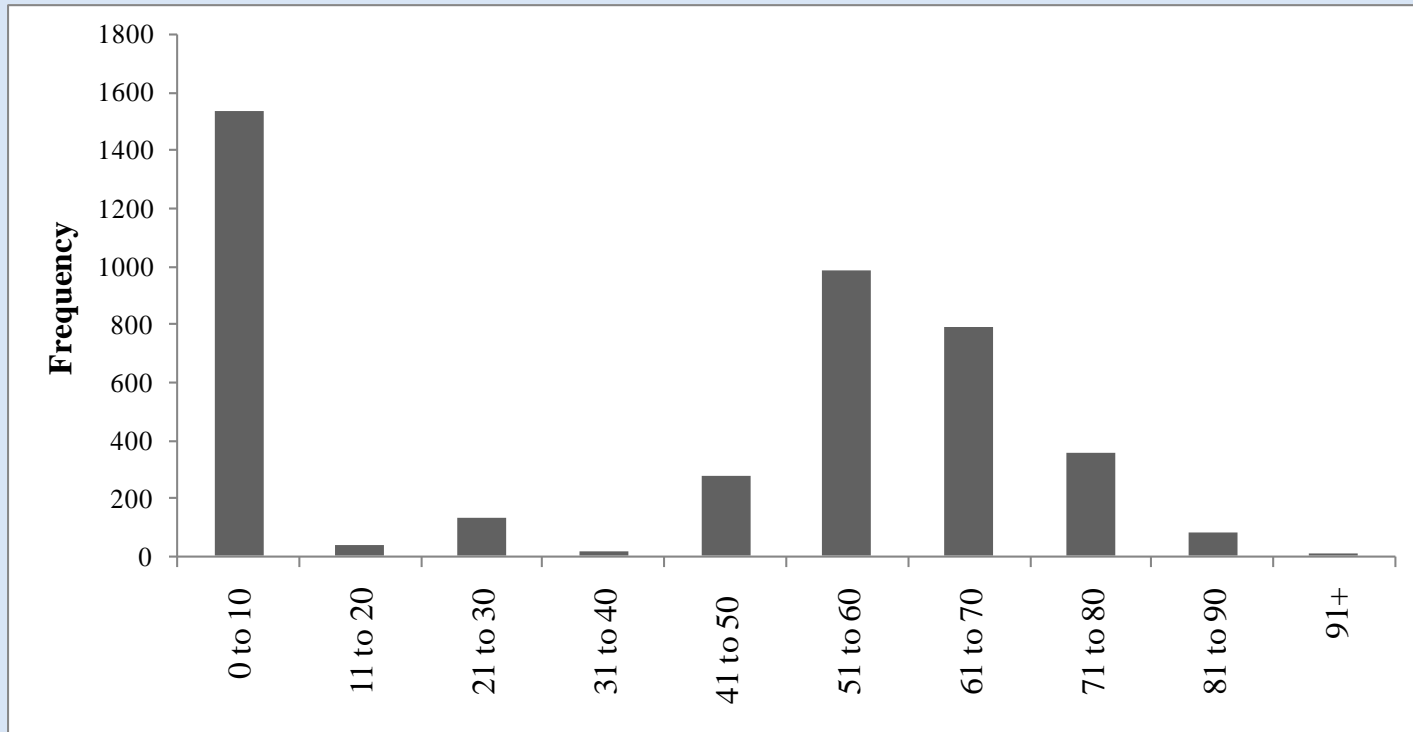


Results/Conclusion: Age Class Histograms



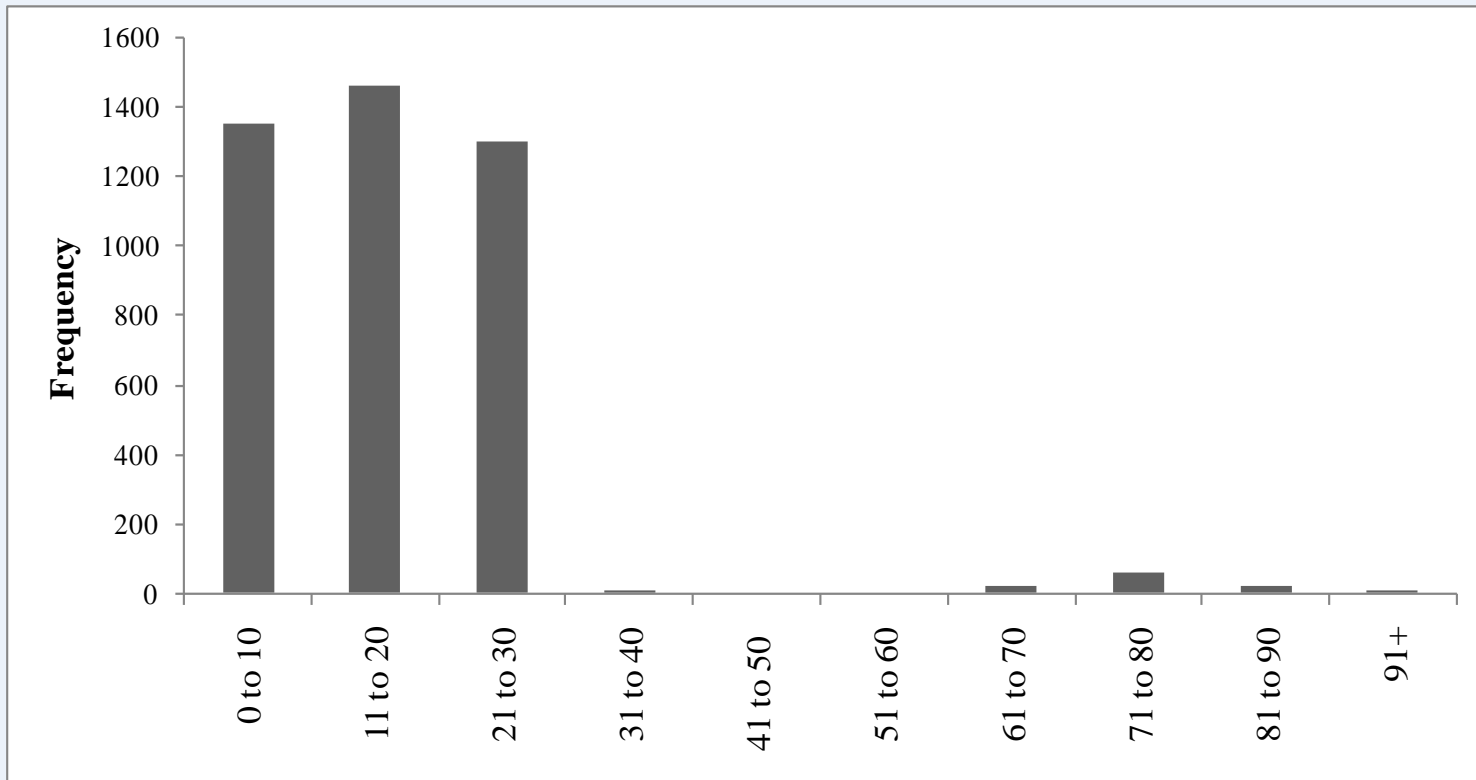
2010

Results/Conclusion: Age Class Histograms



2020

Results/Conclusion: Age Class Histograms



2040

THANKS

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