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# The state-contingent model

John Quiggin and Robert G. Chambers

# Risk and Sustainable Management Group

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# The state-contingent model

- ~ First developed by Arrow and Debreu
- ~ A consistent approach to product differentiation by:
  - ~ quality
  - ~ spatial location
  - ~ time
  - ~ state of nature
- ~ General equilibrium and missing markets

# The case for the state-contingent approach

- ~ Analogy between state-contingent production and choice under uncertainty
- ~ Stochastic production functions as a special case
- ~ Consistency with general equilibrium and finance theory
- ~ Structural forms and reduced forms
- ~ Applicability of modern production theory

# Production and choice

- ~ Risk premiums and production premiums
- ~ Homotheticity and constant risk aversion
  - ~ Absolute and relative
- ~ Flexibility and risk aversion

# Stochastic production functions

- A restrictive special case
- No substitution between states of nature

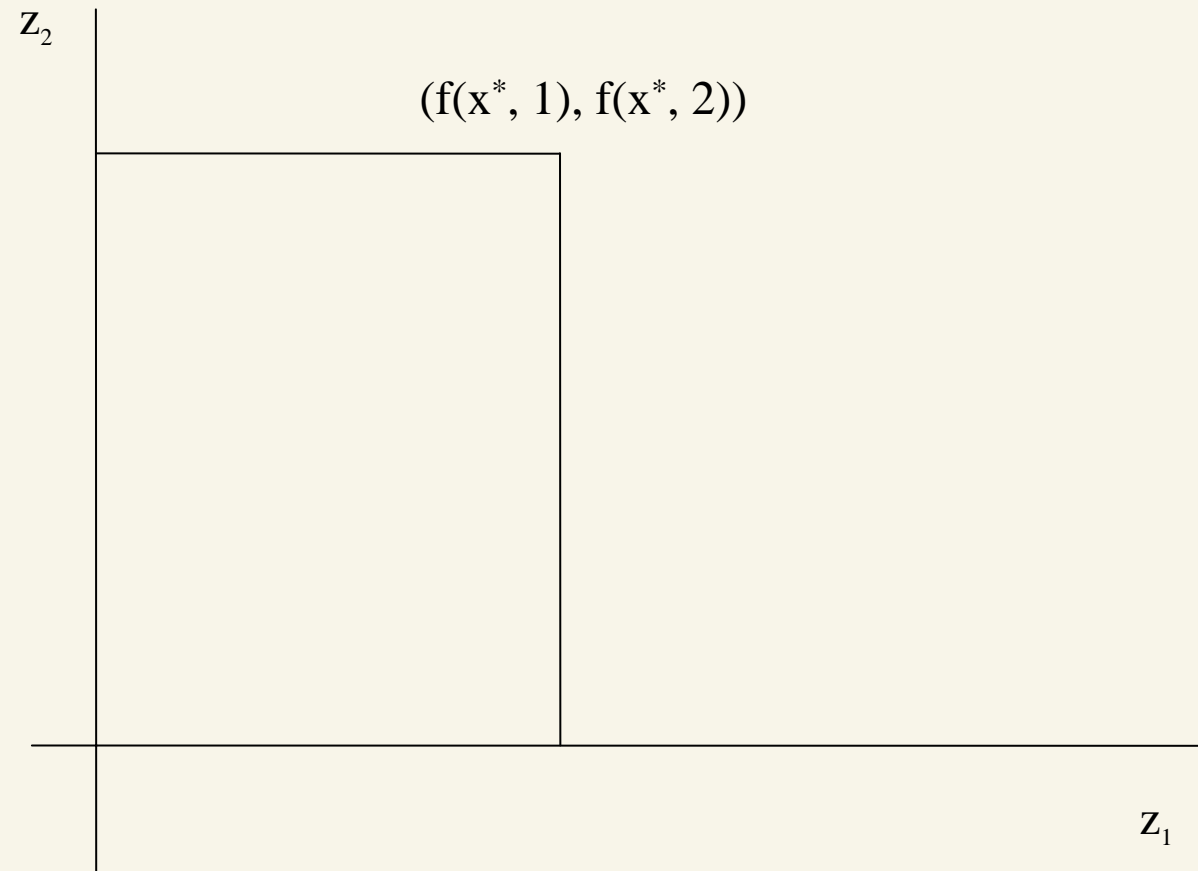


Figure 1: Stochastic production function:  $S=2$



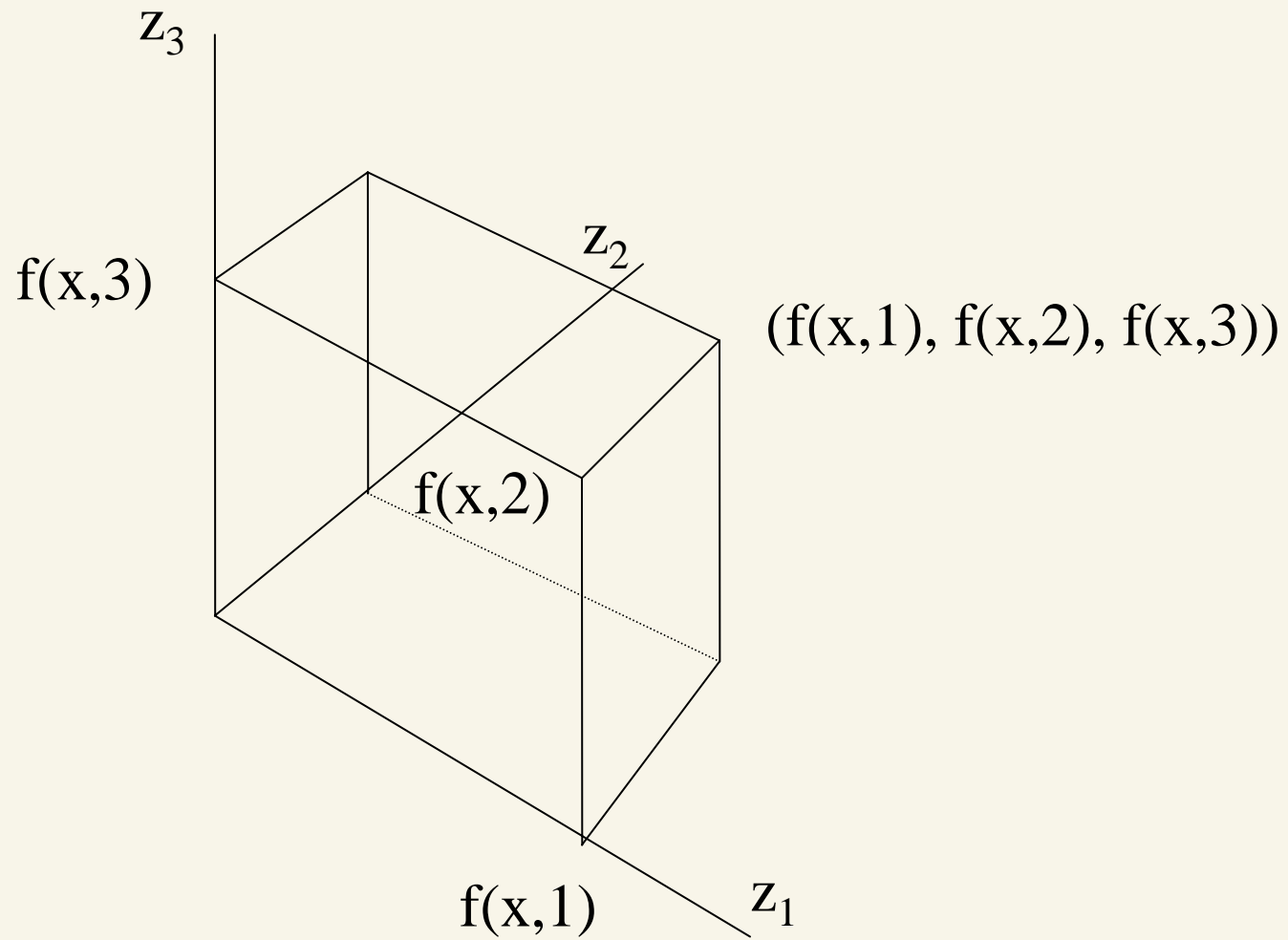


Figure 2: Stochastic production  $S=2$   
Output Cubical Output Set

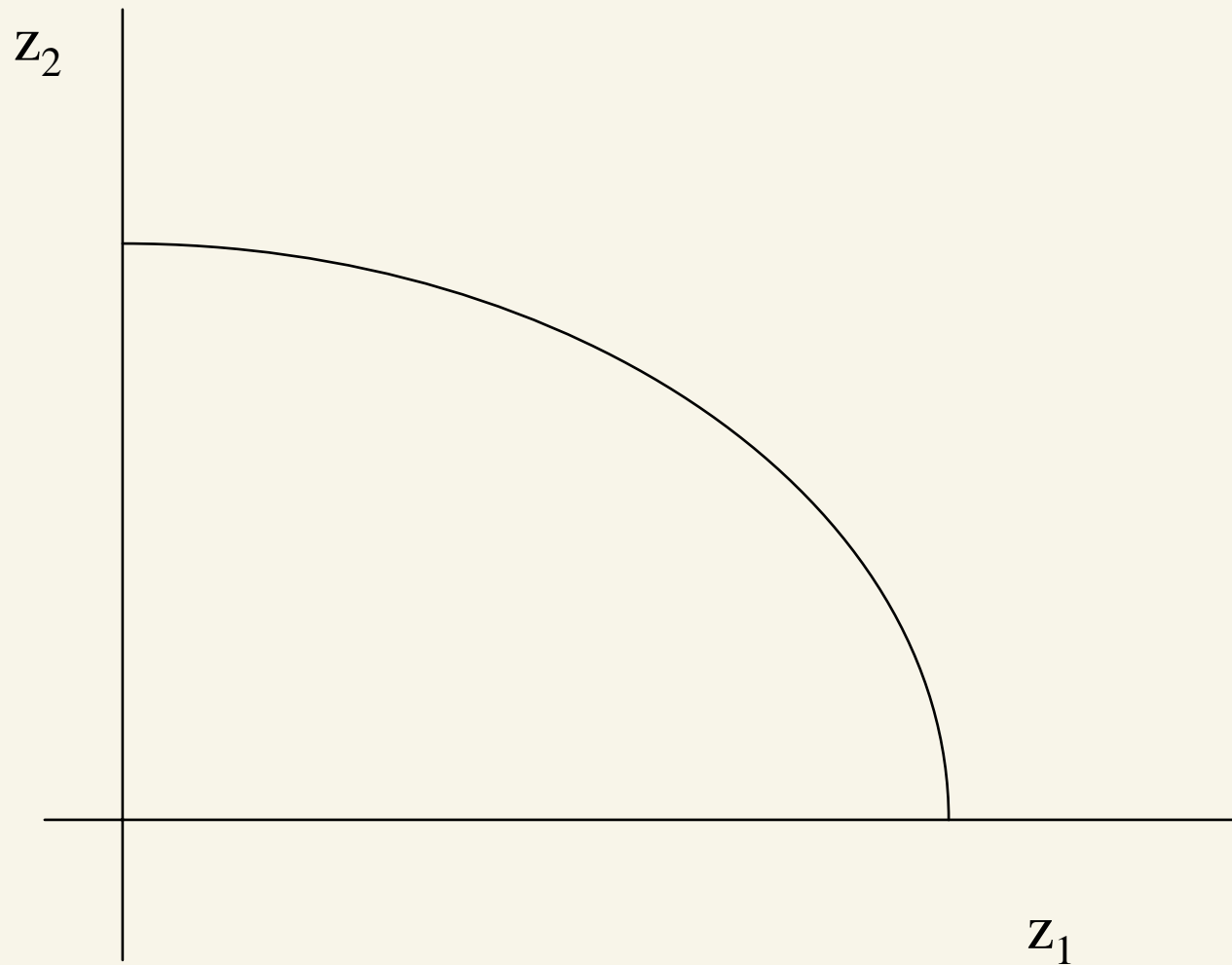


Figure 3: A smooth state-contingent product transformation curve

# GE and finance theory

- ~ Original focus of Arrow and Debreu
- ~ Integrating production and finance decisions
- ~ Incorporating moral hazard

# Structural forms and reduced forms

- ~ Parametrized distribution function is a reduced form
- ~ State-contingent representation is a structural form

# Modern production theory

- ~ Duality
  - ~ Difficult to apply under uncertainty using existing representations
- ~ Convex sets
- ~ Distance and translation functions
- ~ All applicable in state-contingent framework

# Policy applications

- Drought policy
- Contract design
- Price stabilisation

# Drought policy

- Need to model drought preparation
- Stochastic production function model doesn't accommodate this
- Risk-reducing and risk-increasing policies

# Contract design

- Problem is trivial with SPF technology
  - Output in one state determines output in every other state
  - Principal can get first best by ensuring minimum output
- State-contingent model gives a more realistic analysis



# Price stabilisation

- Literature begins with a paradox
  - Waugh- price instability good for consumers
  - Oi - price instability good for producers
- Problem of interpreting supply and demand curves under uncertainty
- State-independent supply curves
  - Generalised Oi result

# Empirical applications

- Efficiency estimation
  - Griffiths and O'Donnell
- Stochastic productivity indicators
  - Chambers analyses US aggregate data
- Asset pricing
- Simulation modelling
  - Murray-Darling Basin

# The state-contingent approach

- The best way to think about all problems in the economics of uncertainty, including problems of consumer choice, the theory of the firm and principal-agent relationships.