

MSE: **(Management Strategy Evaluation)**

WHAT, WHY and WHEN

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OUTLINE

I. What is MSE? (IWC/CCSBT interpretation)

II. Why should MSE be implemented?

- Feedback control

III. When should MSE be implemented?

IV. Short lived species (a brief remark)

I. WHAT IS MSE?

■ What is a Management Procedure?

An agreed formula, with an agreed set of data inputs, used to calculate a recommendation for a fisheries management measure – typically a TAC

■ MSE is the process of developing and agreeing a Management Procedure

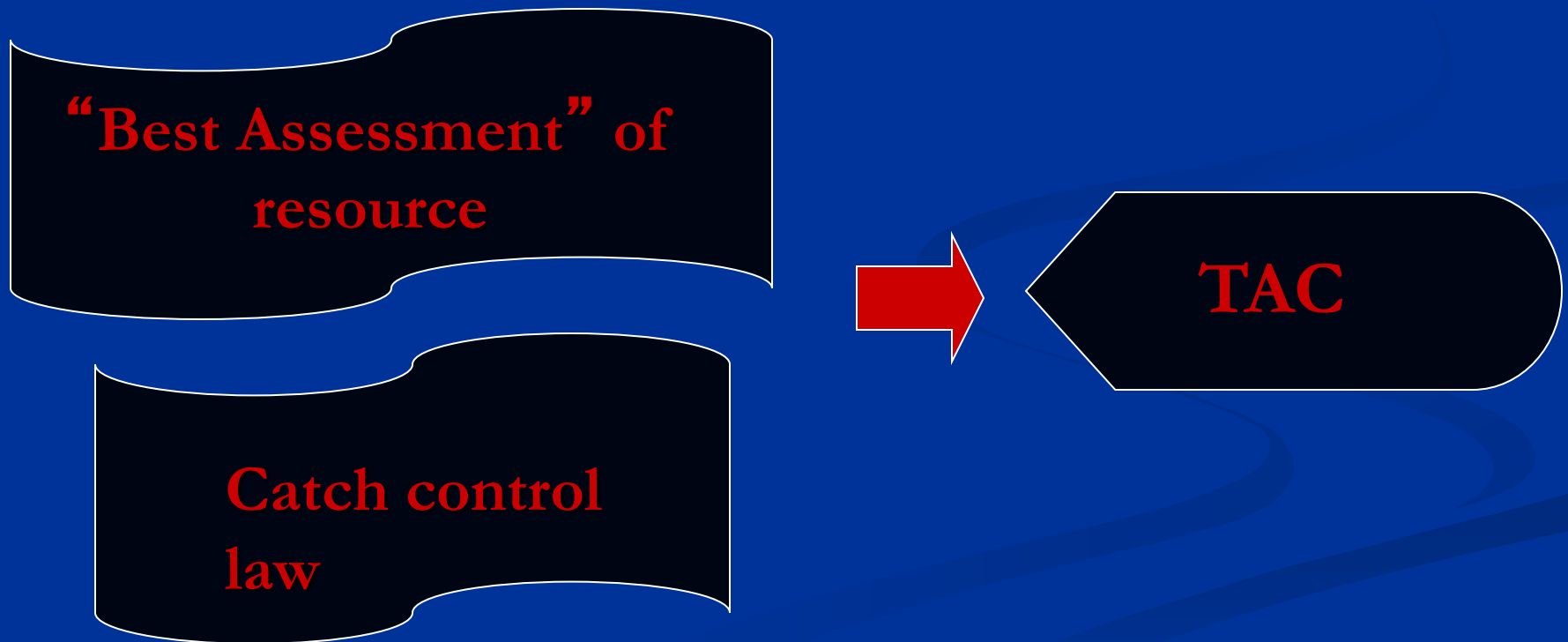
(At least for our purposes today)

II. WHY SHOULD MSE BE IMPLEMENTED?

Because of shortcomings with best-assessment-based management

BEST-ASSESSMENT-BASED MANAGEMENT

E.g. US Magnuson-Stevens Act with its MSY-related recovery targets



DIFFICULTIES FOR THE BEST-ASSESSMENT-BASED APPROACH

- Inter-annual best assessment/TAC variation (including MSY-related Reference points)
- No consideration of longer term trade-offs (which requires taking account of management responses to future resource monitoring data)
- Lengthy haggling
- What if the “best assessment” is wrong?
- Default decision of “no change”

BUT WHY IS FISHERIES MANAGEMENT SO DIFFICULT?

SUSTAINABLE UTILISATION

- Pensioner must live off interest
- What's my capital?
- What's the interest rate?
- Multiply the two
- Don't spend more than that!

EASY!!

THE SOURCE OF THE DIFFICULTY

FISHERIES HAVE UNCO-OPERATIVE BANK TELLERS

- They won't tell you the interest rate, which in any case is highly variable

Recruitment fluctuations

- They will advise your balance only once a year, with a typically $\pm 50\%$ error, and in the wrong currency

Surveys are typically annual only, results have high variance, and bias is unknown

MANAGEMENT PROCEDURES (MSE)

WHAT NEW DO THEY BRING TO
ASSIST SOLVE THE PROBLEM?

FEEDBACK CONTROL!

Monitor stock changes and adjust
management measures (e.g. TACs)
accordingly

A FINANCIAL ANALOGY

\$1 000 000 invested at 5% p.a.

Each year withdraw \$50 000 \Rightarrow

Investment sustainably maintained at \$1 000 000

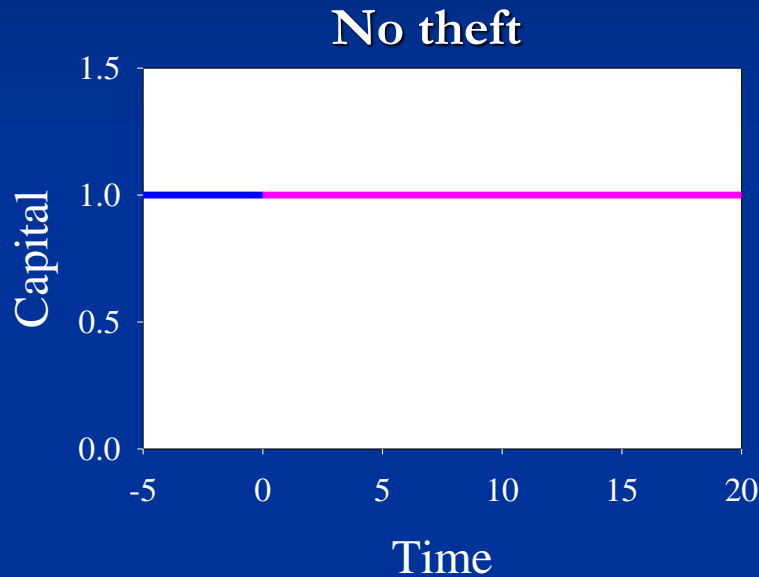
1 000 000 ton fish stock grows naturally at 5% p.a.

Each year catch 50 000 tons \Rightarrow

Sustainable exploitation: resource kept at 1 000 000 tons

After 5 years, someone MAY have stolen \$300 000 from your investment

You keep withdrawing \$50 000 per year



After 5 years, recruitment failure or IUU fishing MAY have reduced abundance by 30%

Catches maintained at 50 000 tons per year

If this event did occur, resource is rapidly reduced

WHY' S THERE ANY PROBLEM?

Ask the teller for account balance.

If this has fallen to \$700 000, reduce annual withdrawal to \$35 000 \Rightarrow

Sustainability maintained.

BUT

The teller will advise balance only once a year
with $\pm 50\%$ error

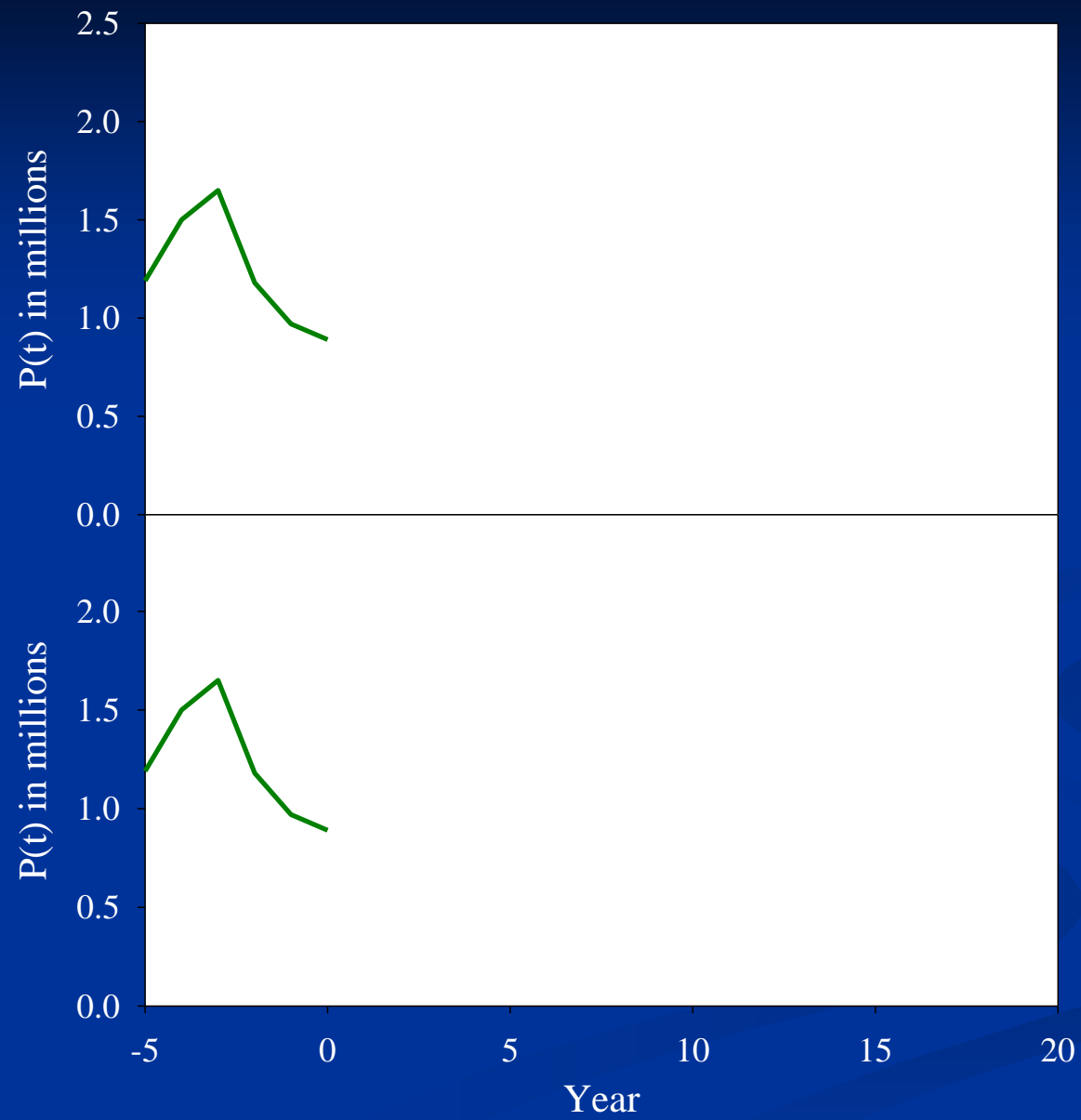
Resource abundance known only through annual surveys which have large associated errors

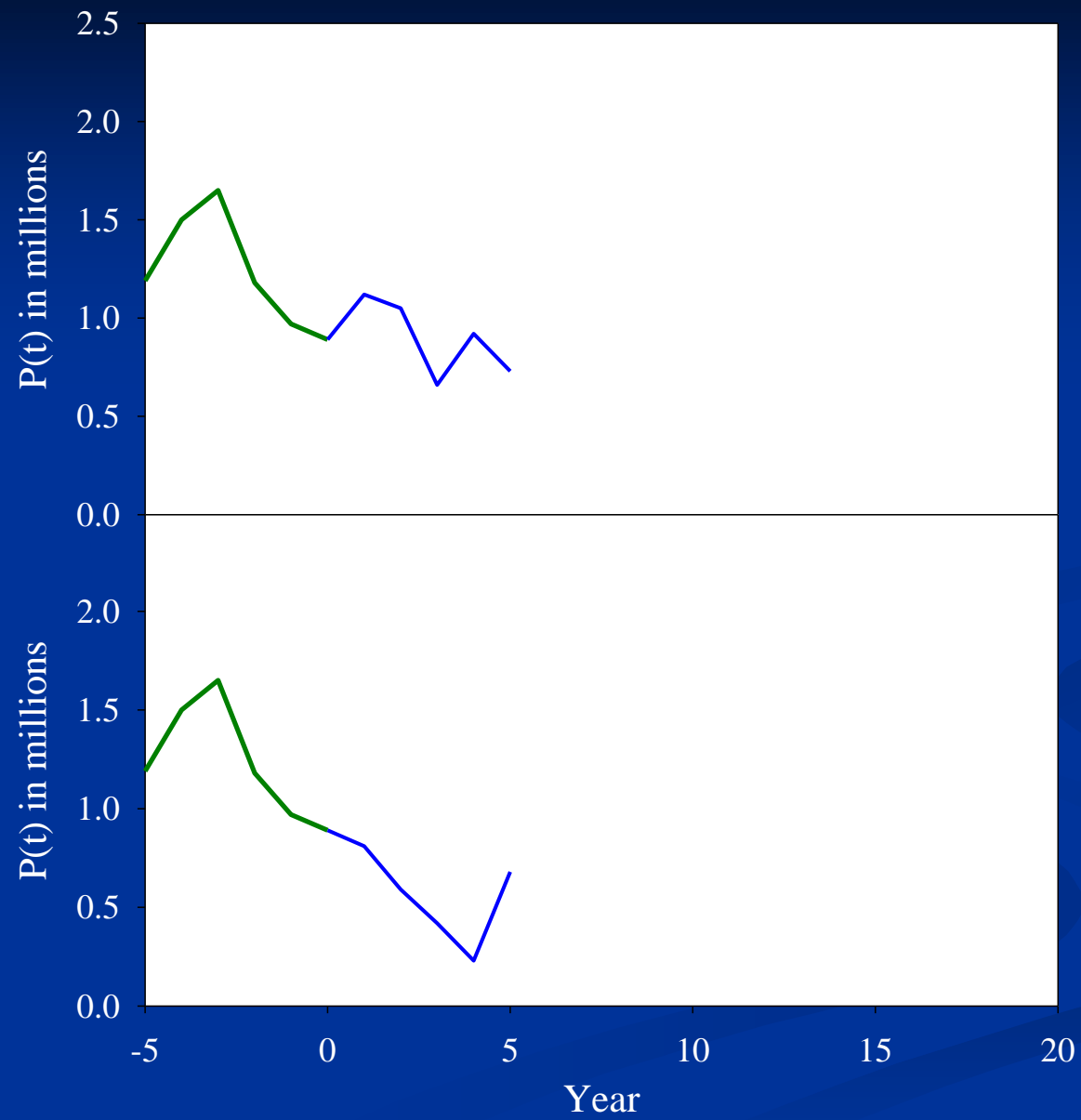
**CAN YOU TELL WHETHER \$300 000 WAS
STOLEN FROM YOUR ACCOUNT ?**

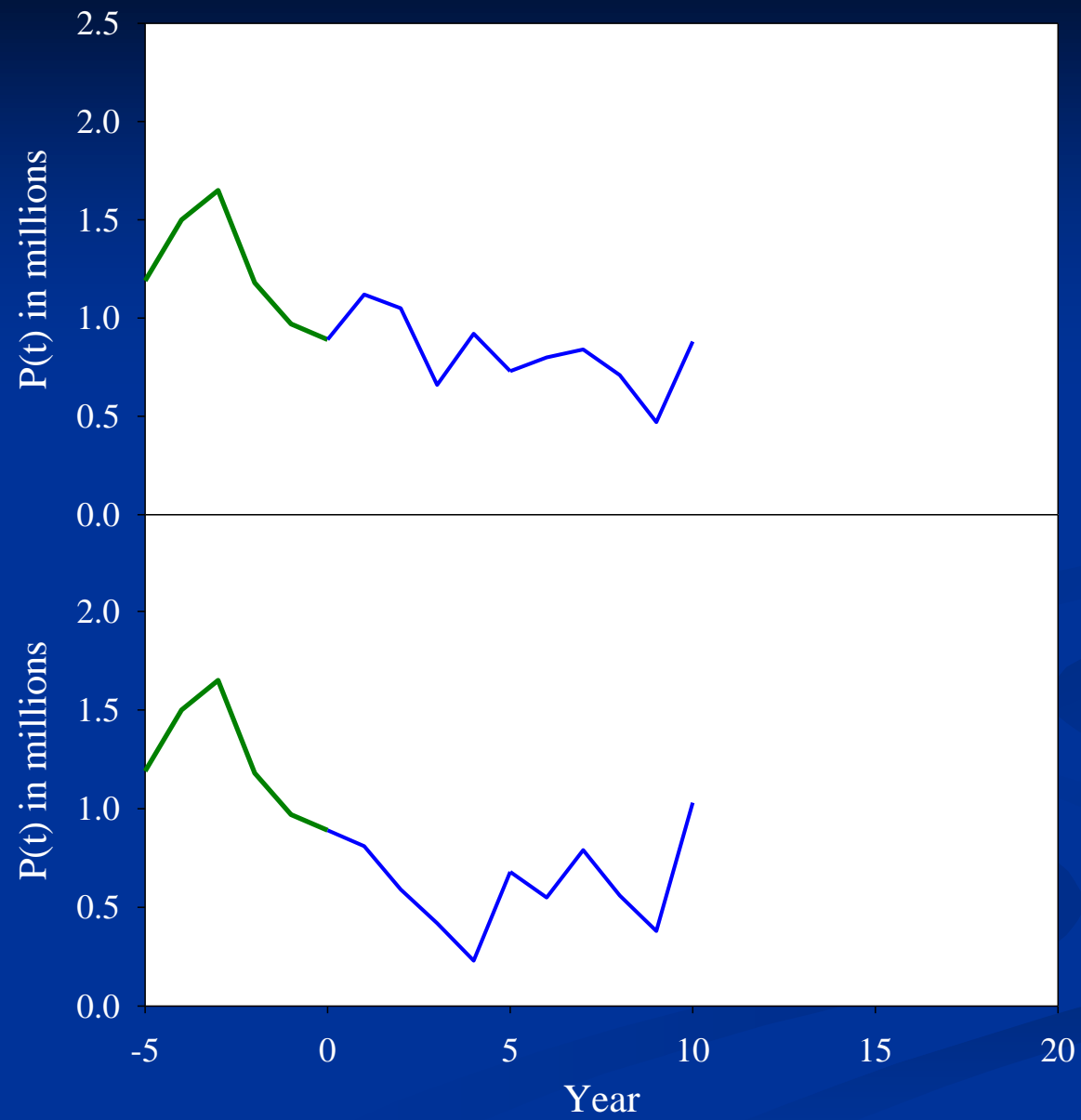
**(Equivalently, whether fish abundance was
reduced by 30%?)**

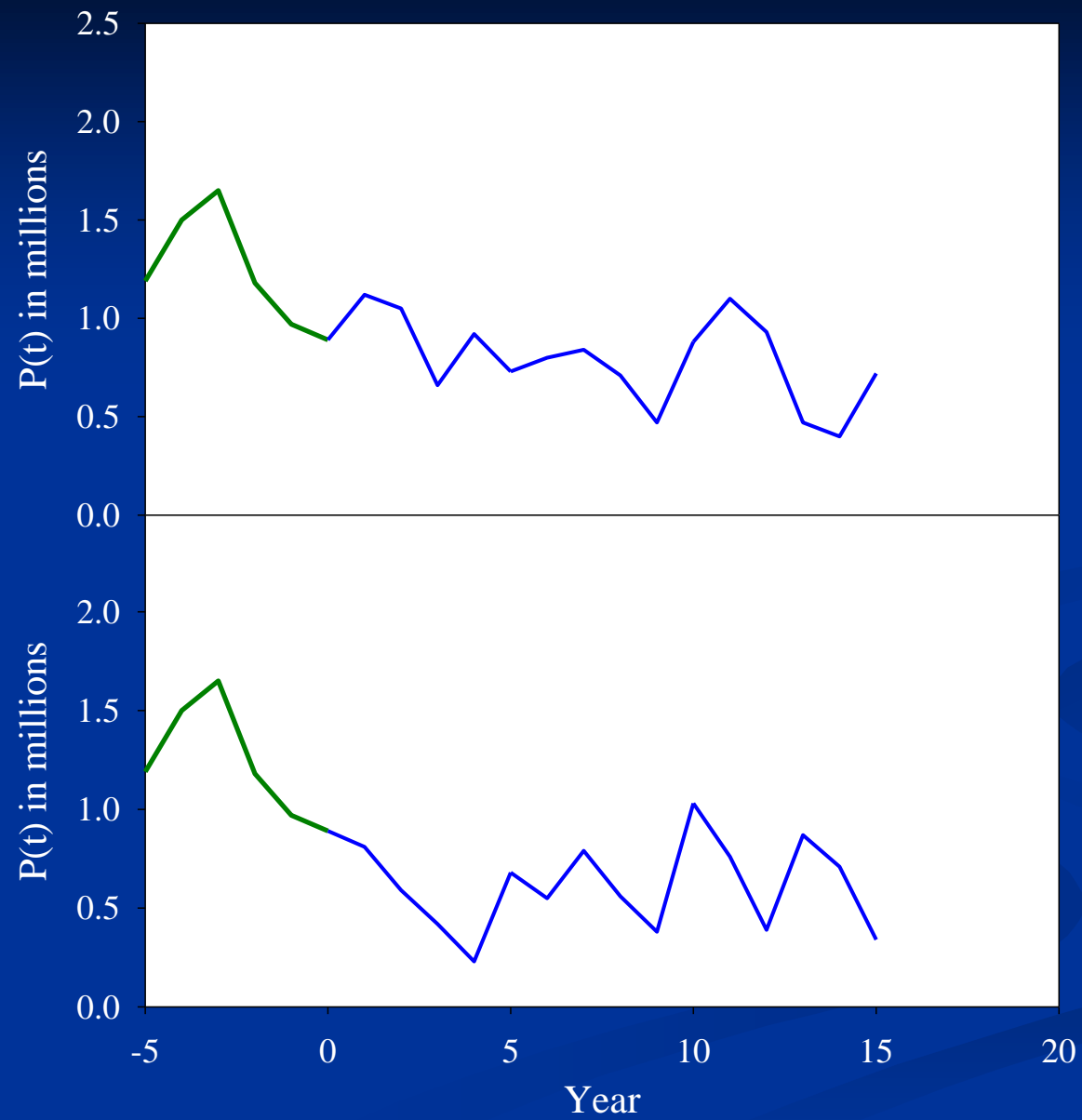
**In each of the following scenarios shown, the
theft occurred in only one of the two cases**

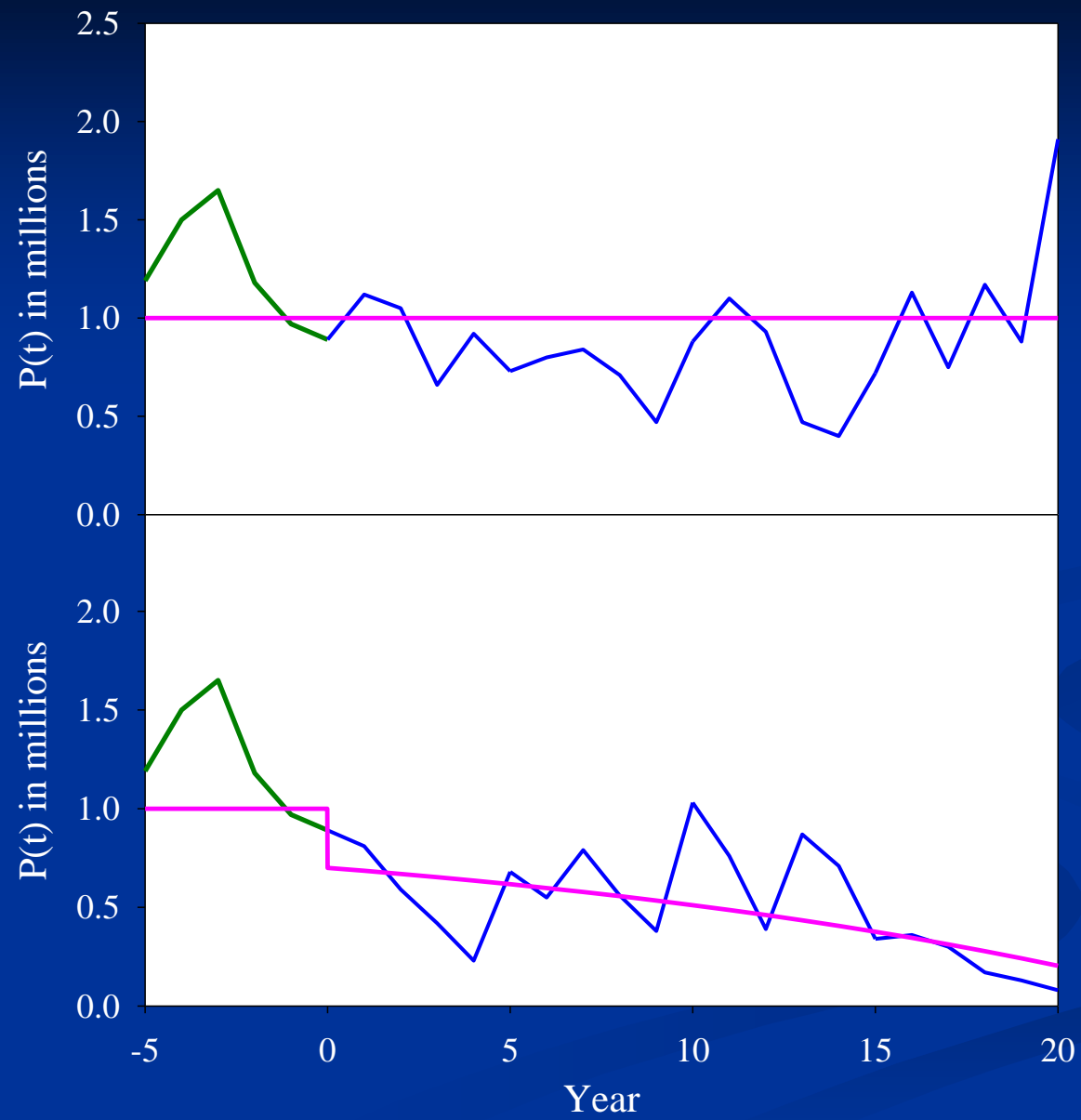
Can you tell which one?

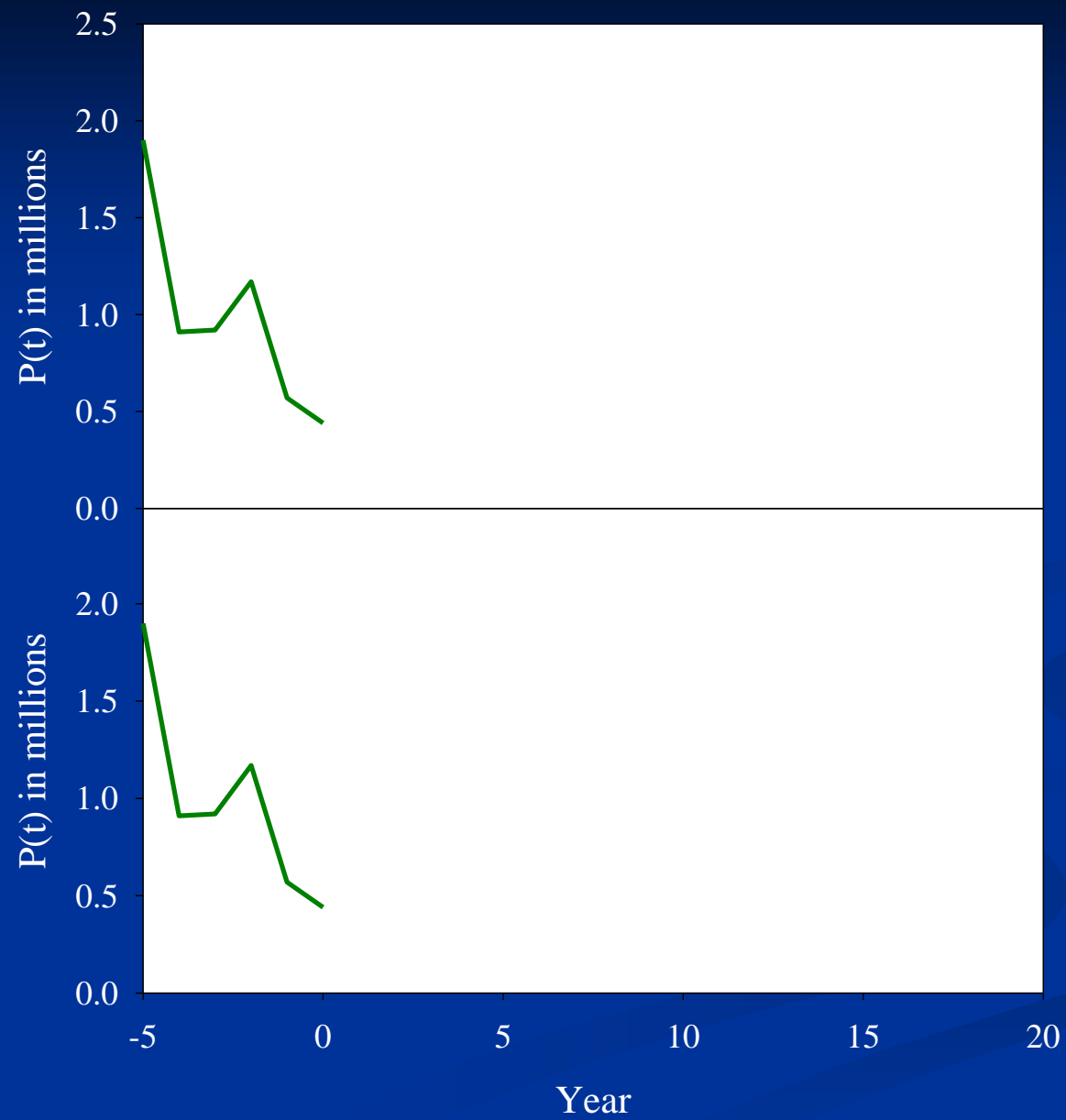


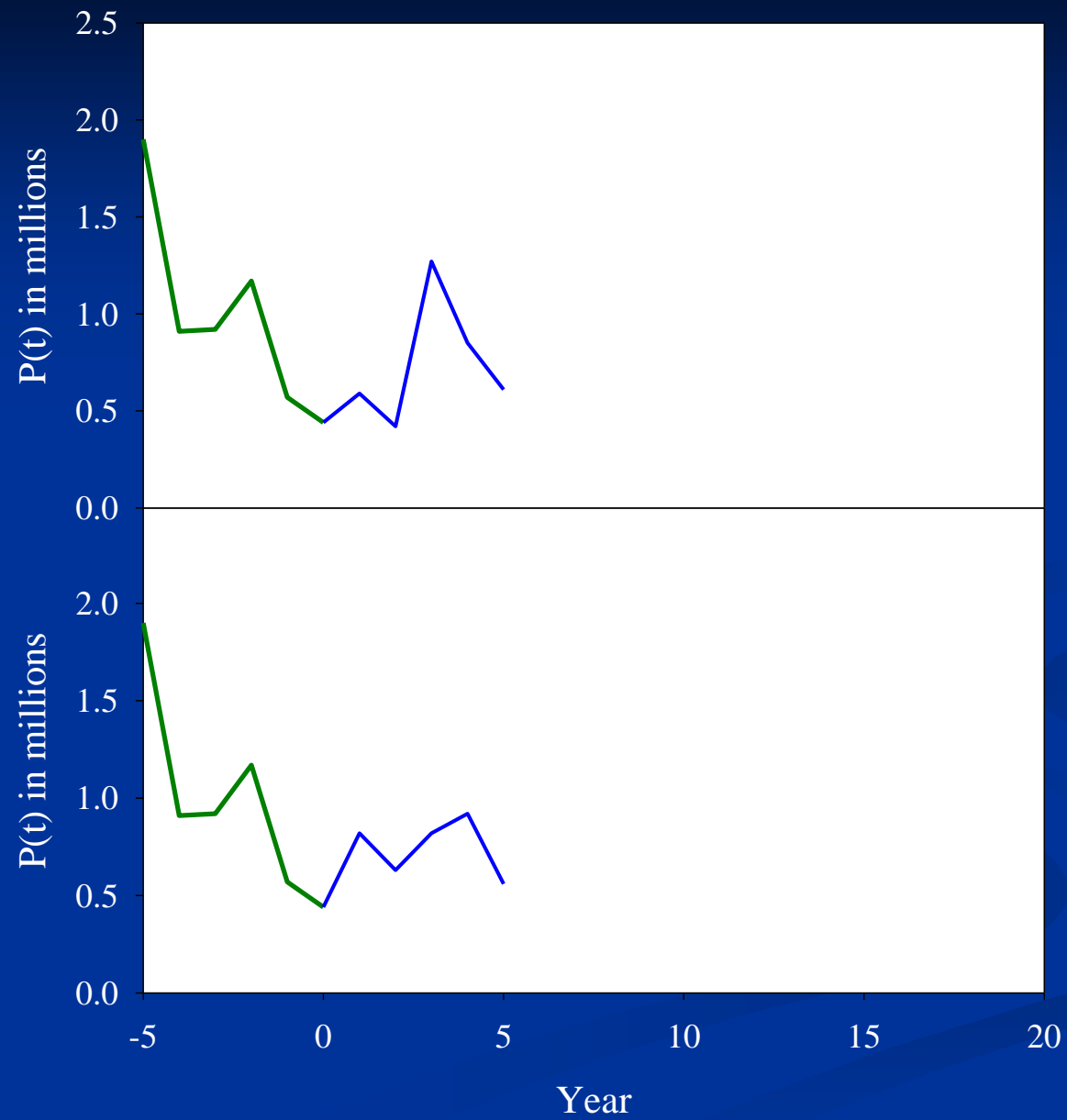


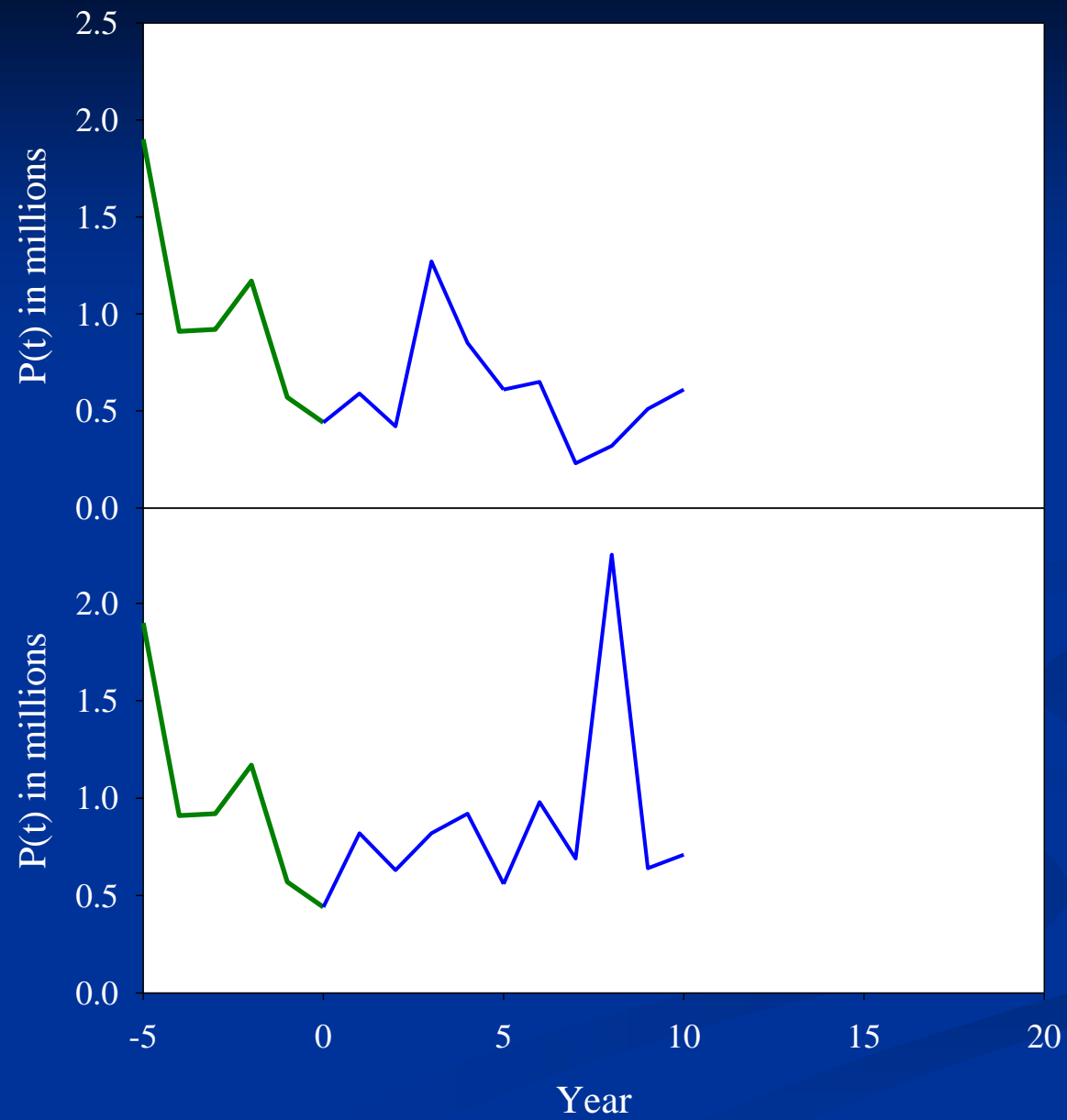


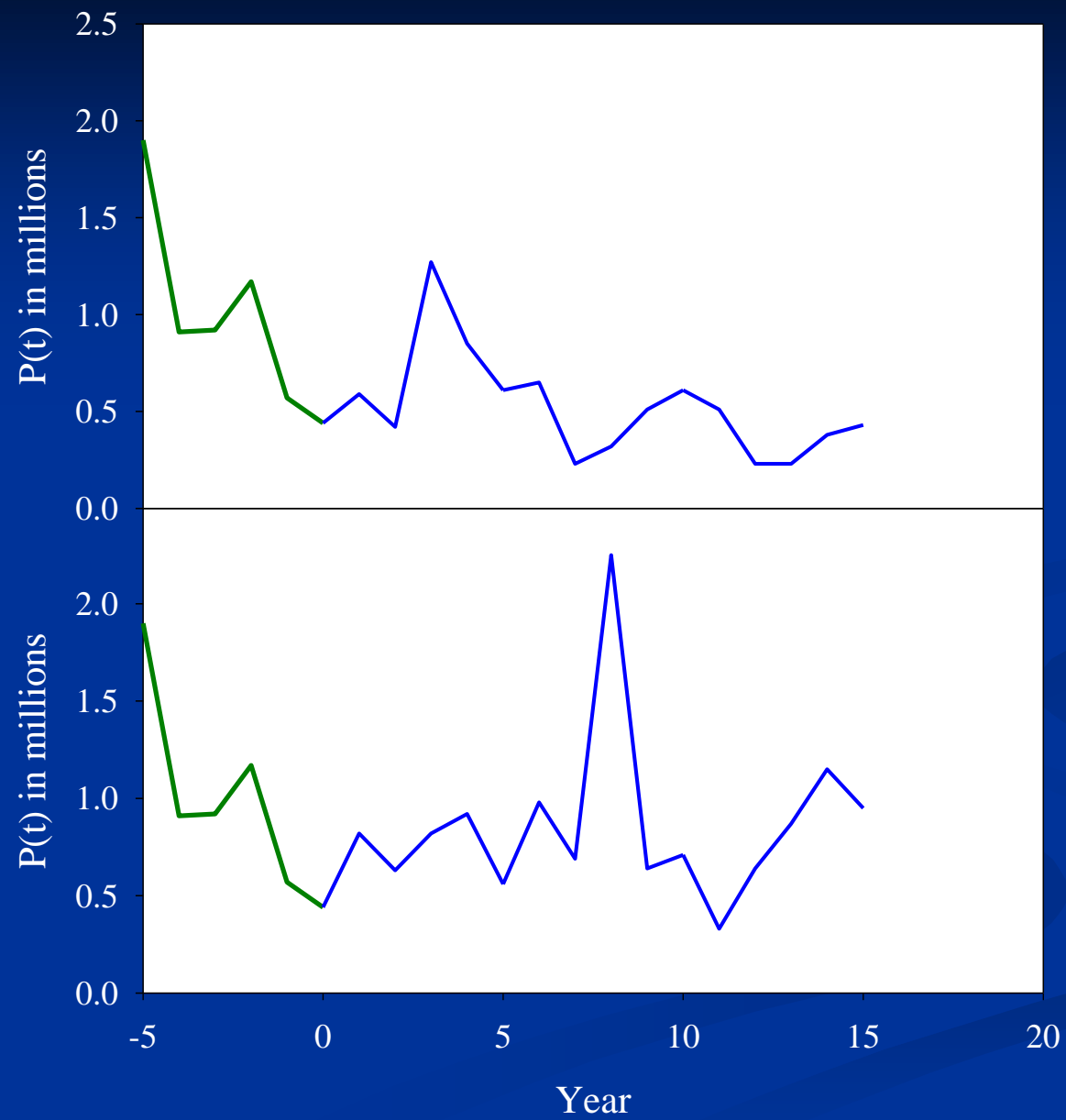


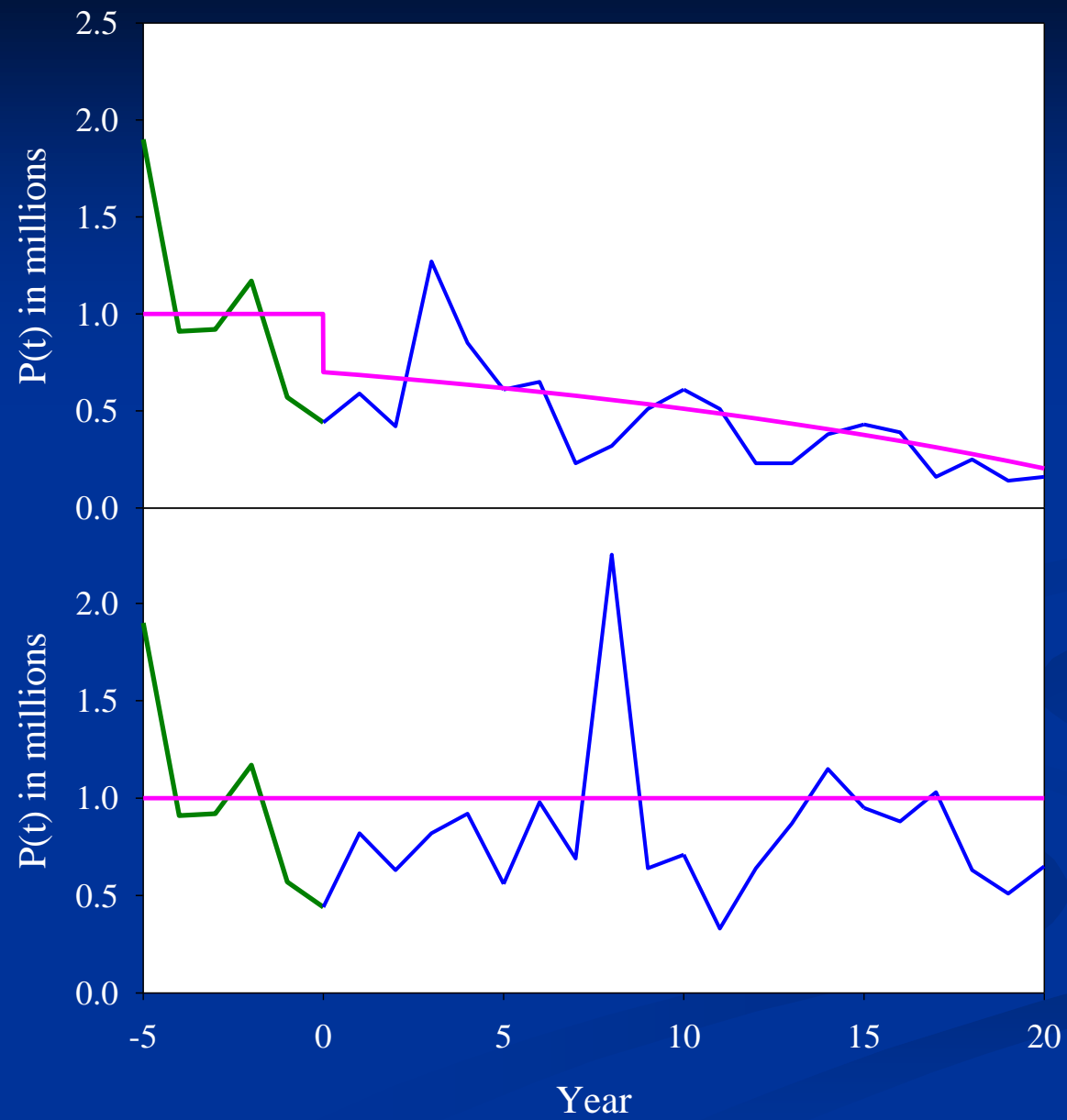


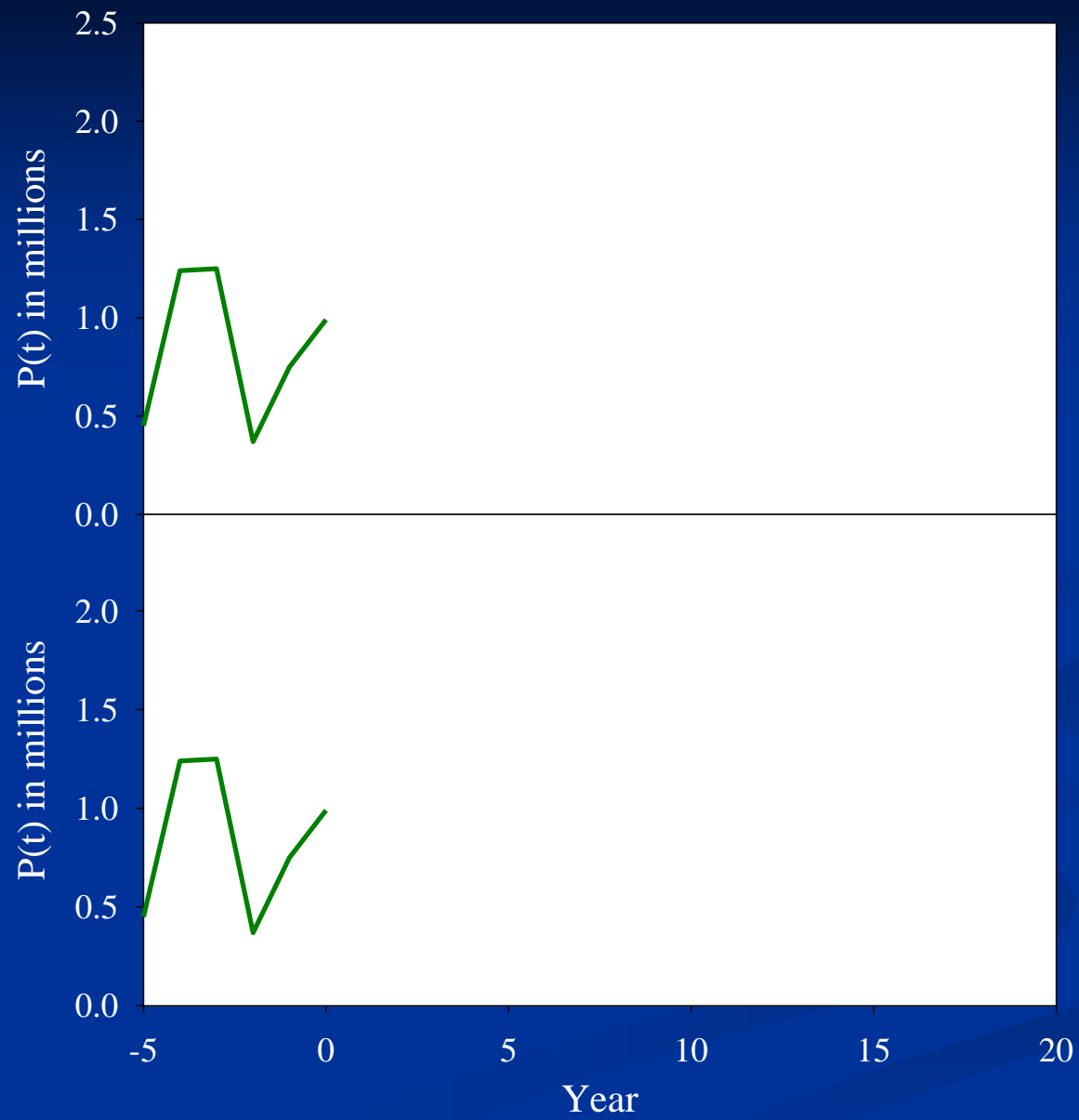


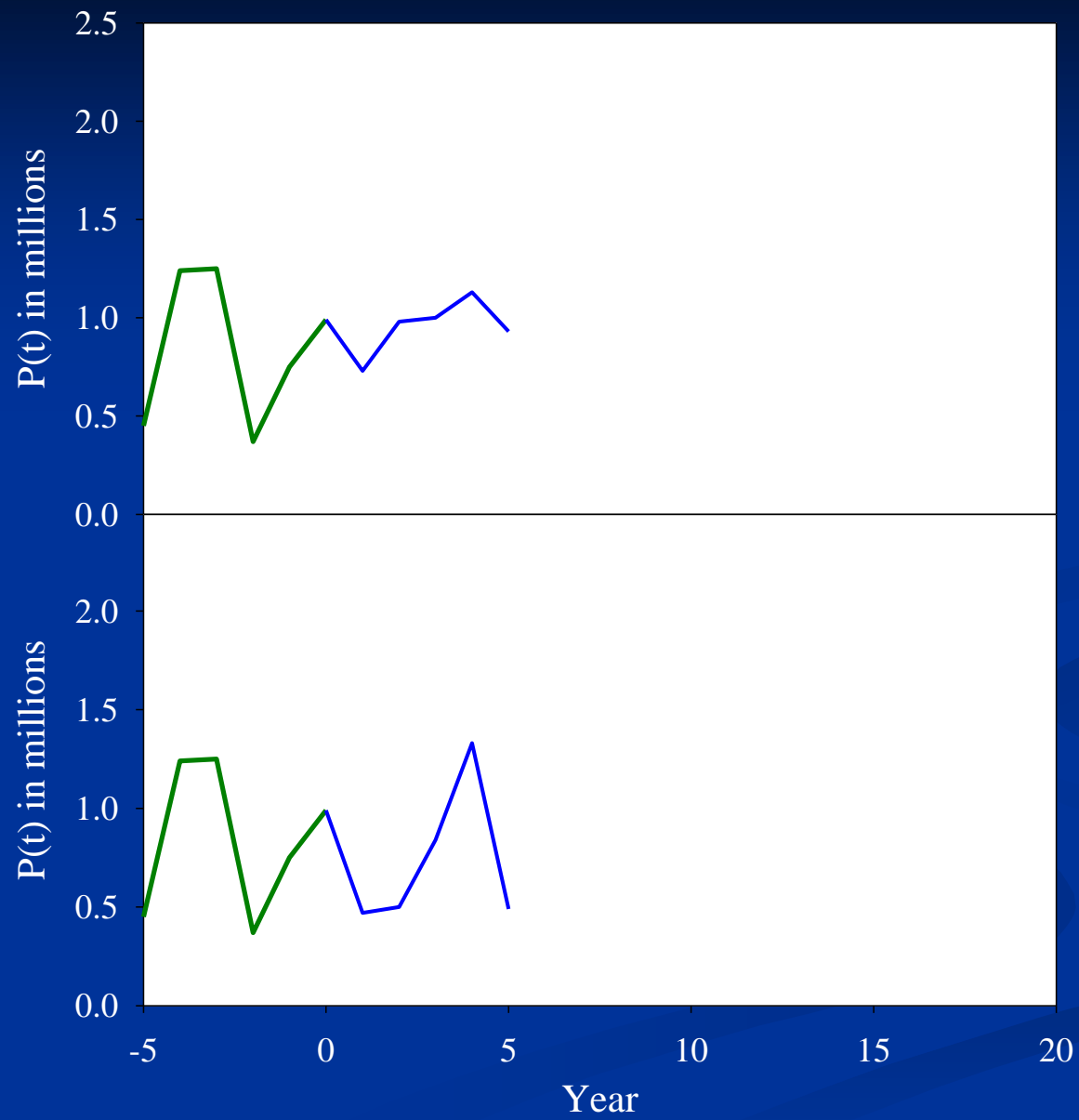


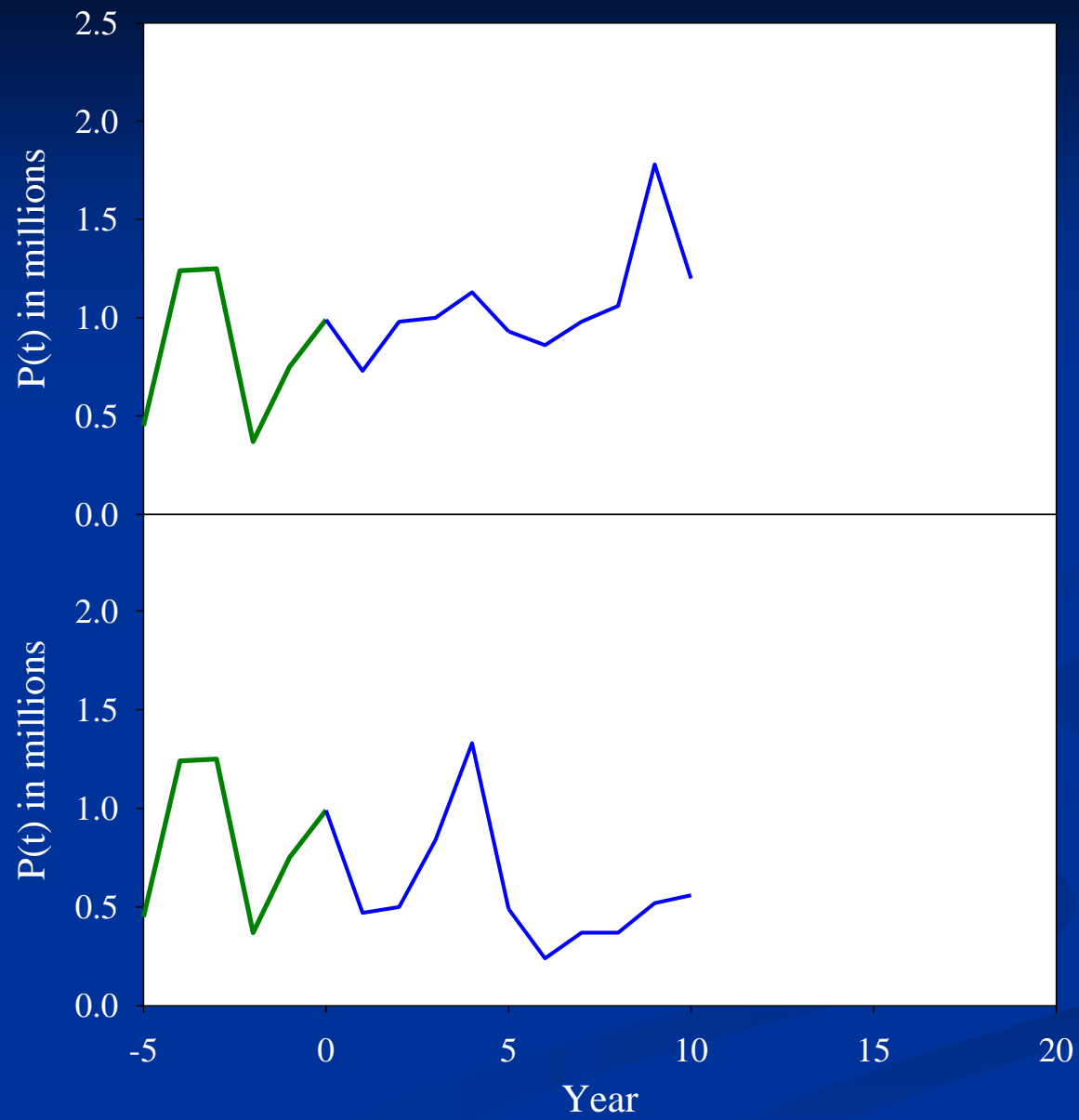


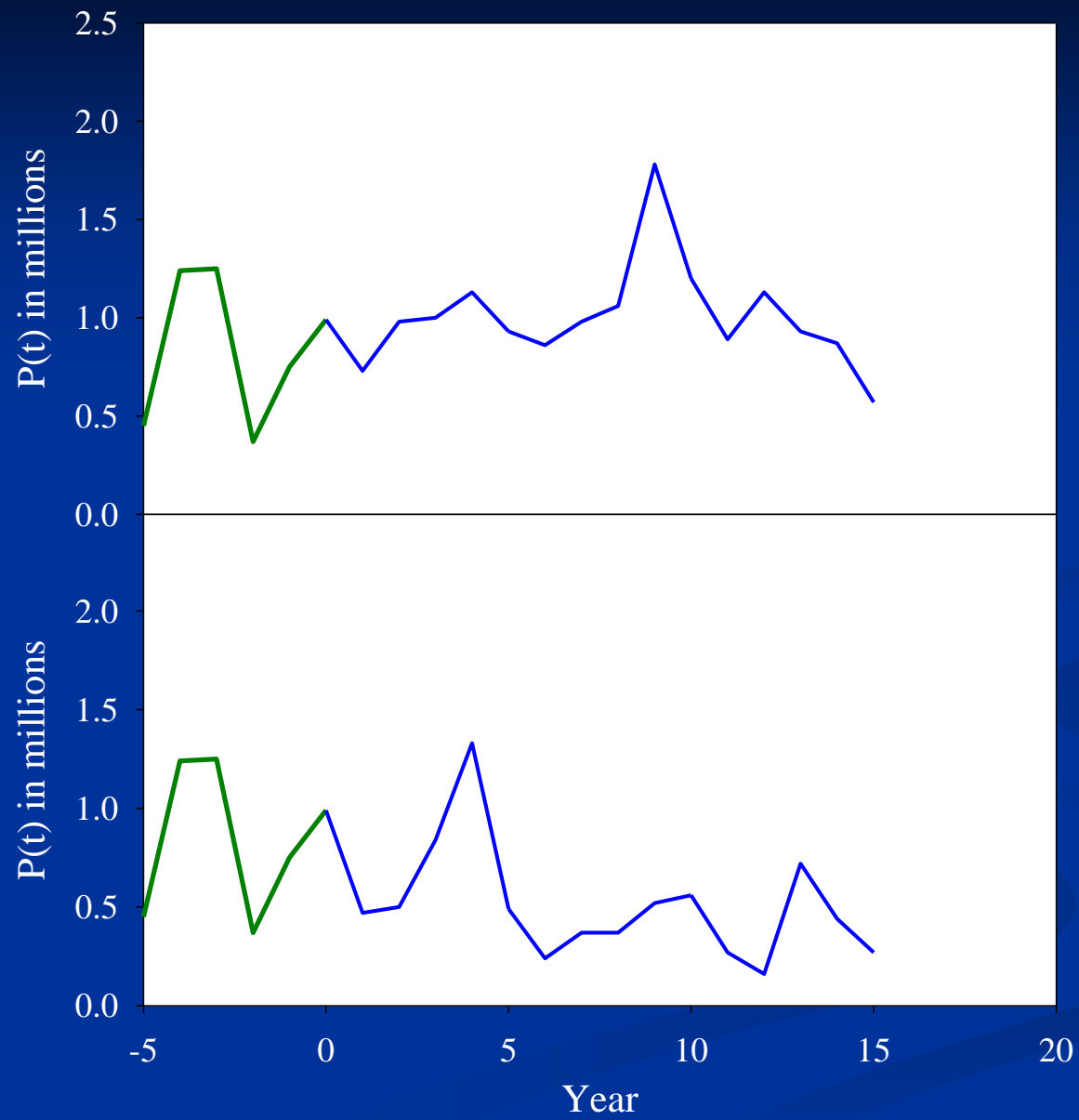


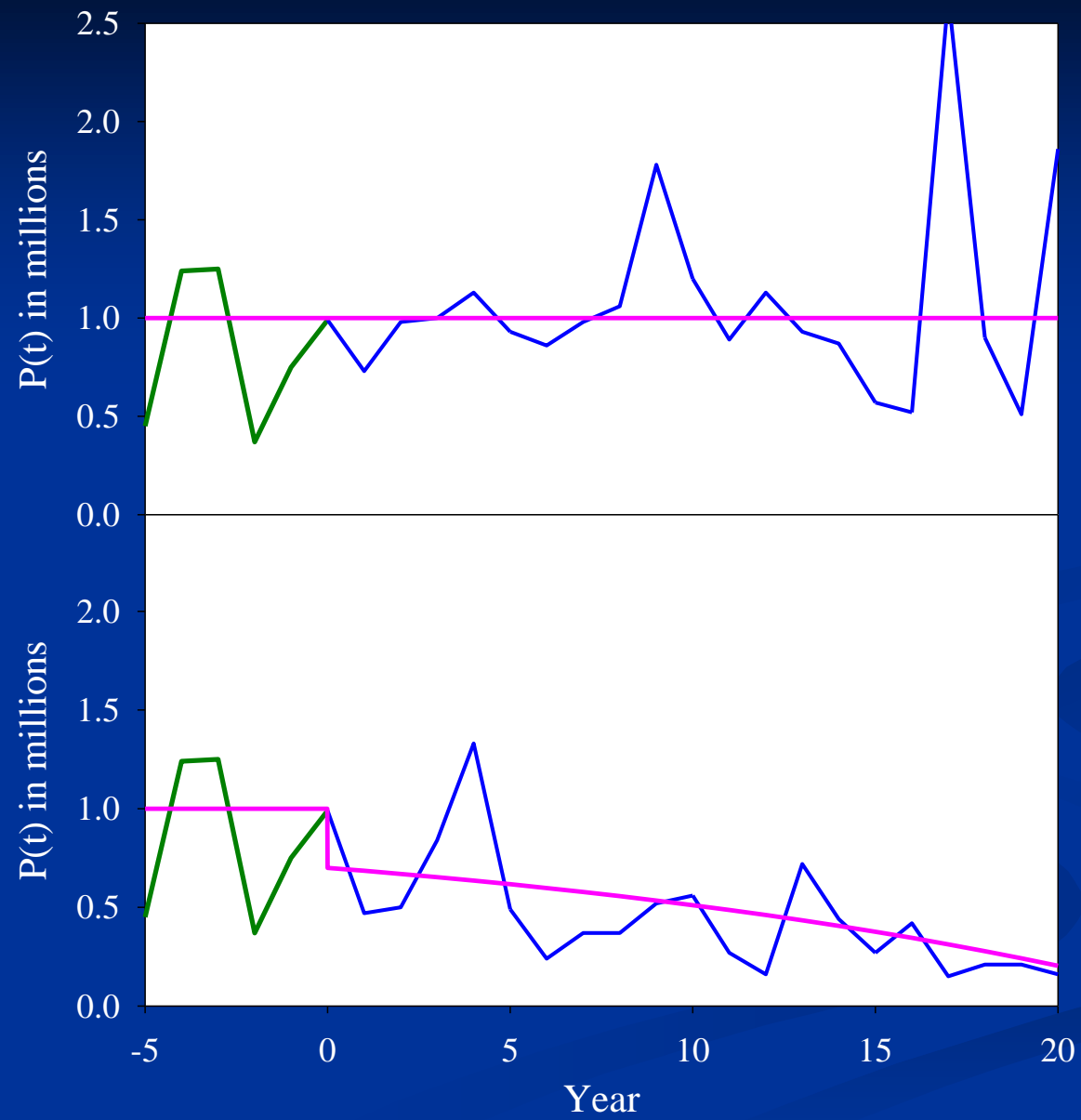












IMPRESSIONS

- It wasn't easy to tell
- It needed usually about 20 years of new data to be certain
- By that time, account was almost exhausted (if theft had occurred)
- By the time the adverse effect of recruitment failure or IUU fishing is detectable, the resource is already heavily depleted

THREE STRATEGIES (MPs)

I: Withdraw \$ 50 000 every year

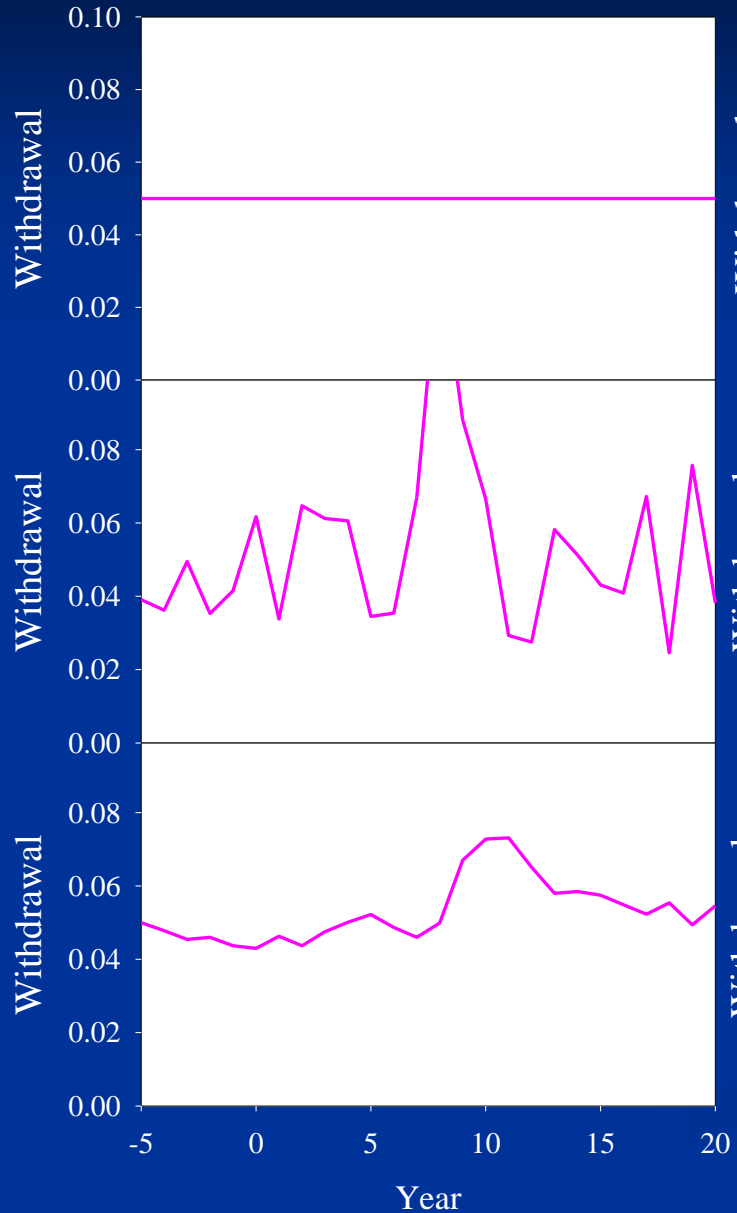
II: Withdraw 5% of the teller-advised balance each year

III: Withdrawal this year = 80% last year's withdrawal + 1% teller's (erroneous) balance

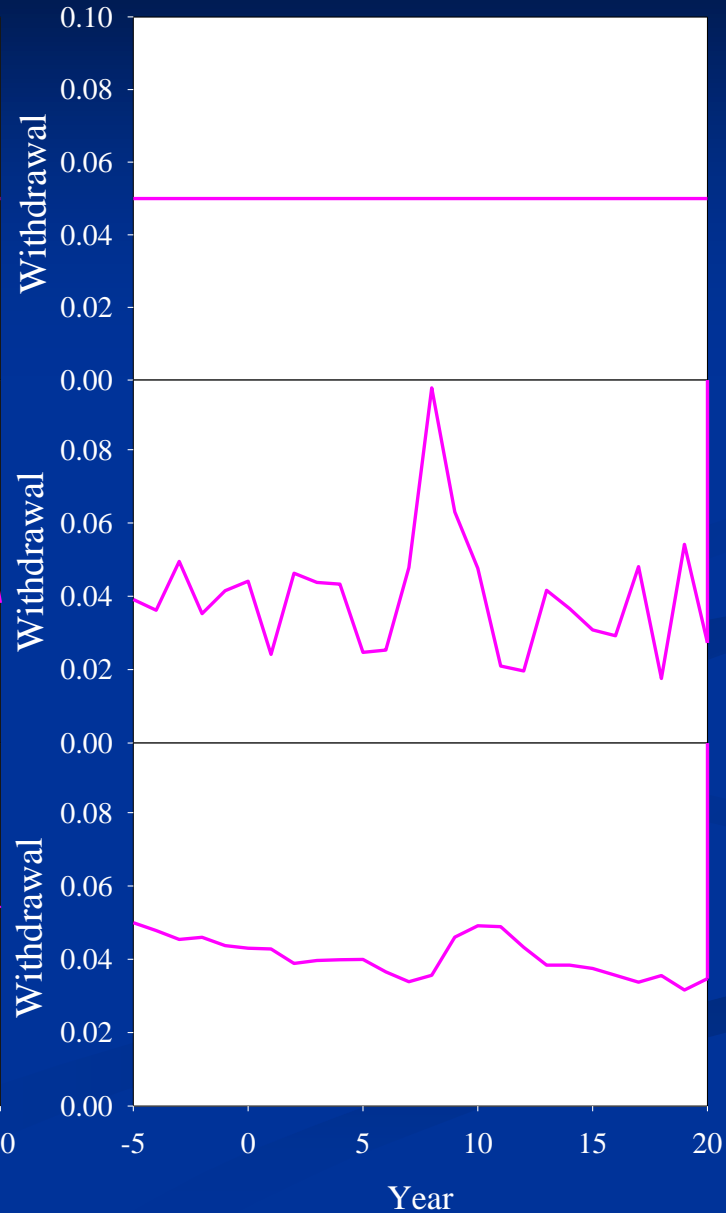
Strategy must “work” whether or not theft occurred

Annual Withdrawal

No theft



Theft



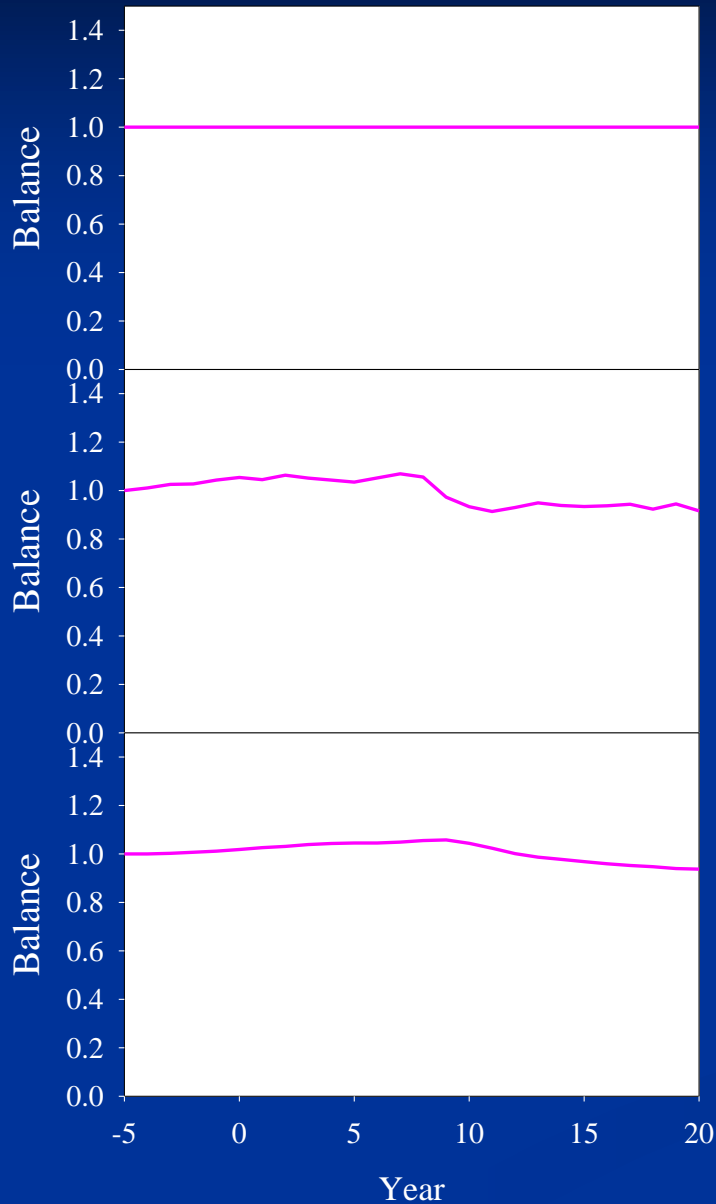
I

II

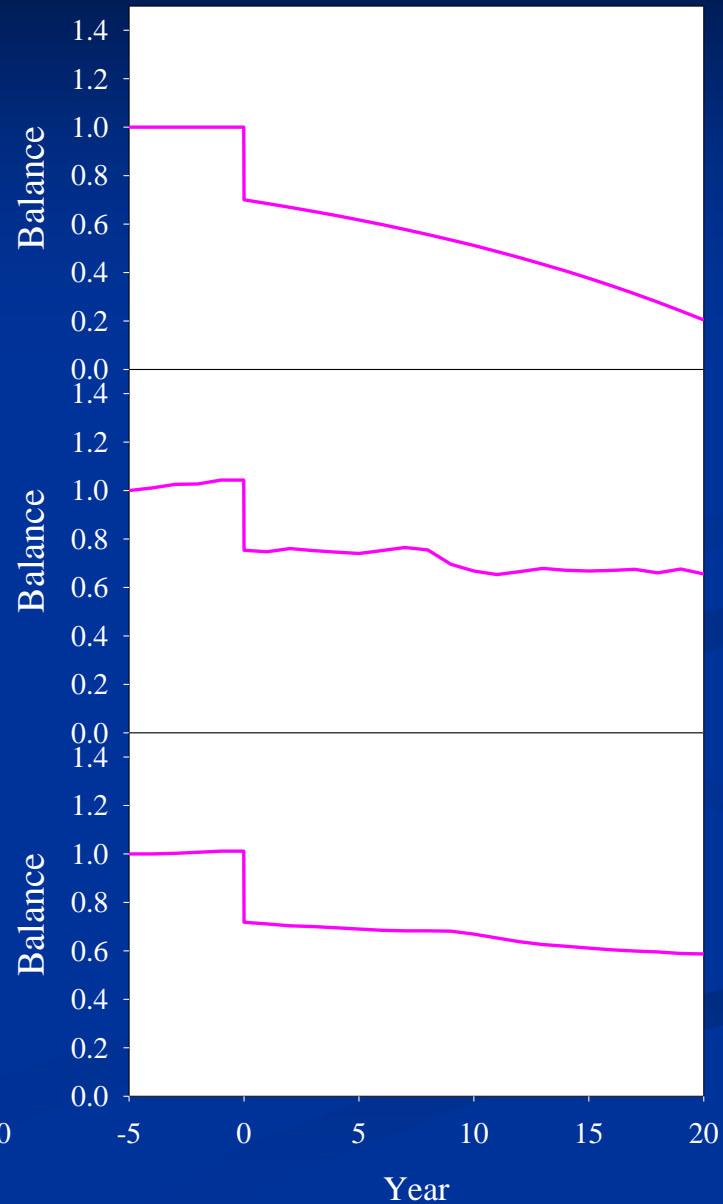
III

Balance in Account

No theft



Theft



I

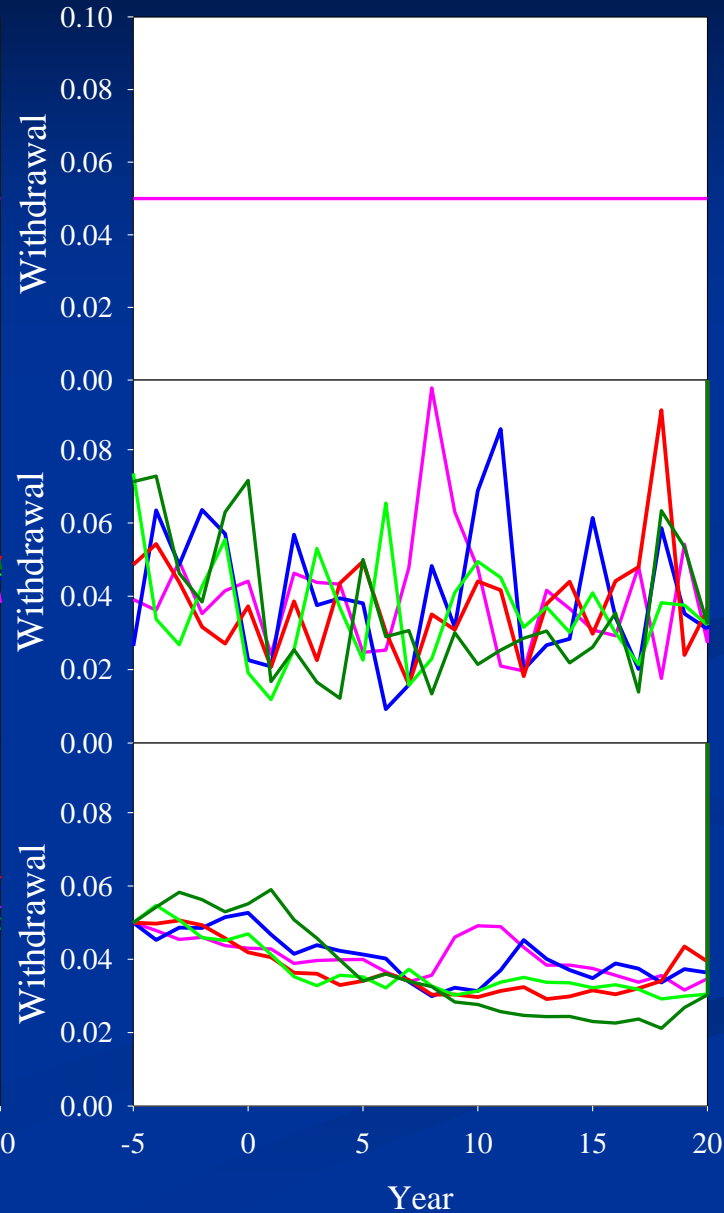
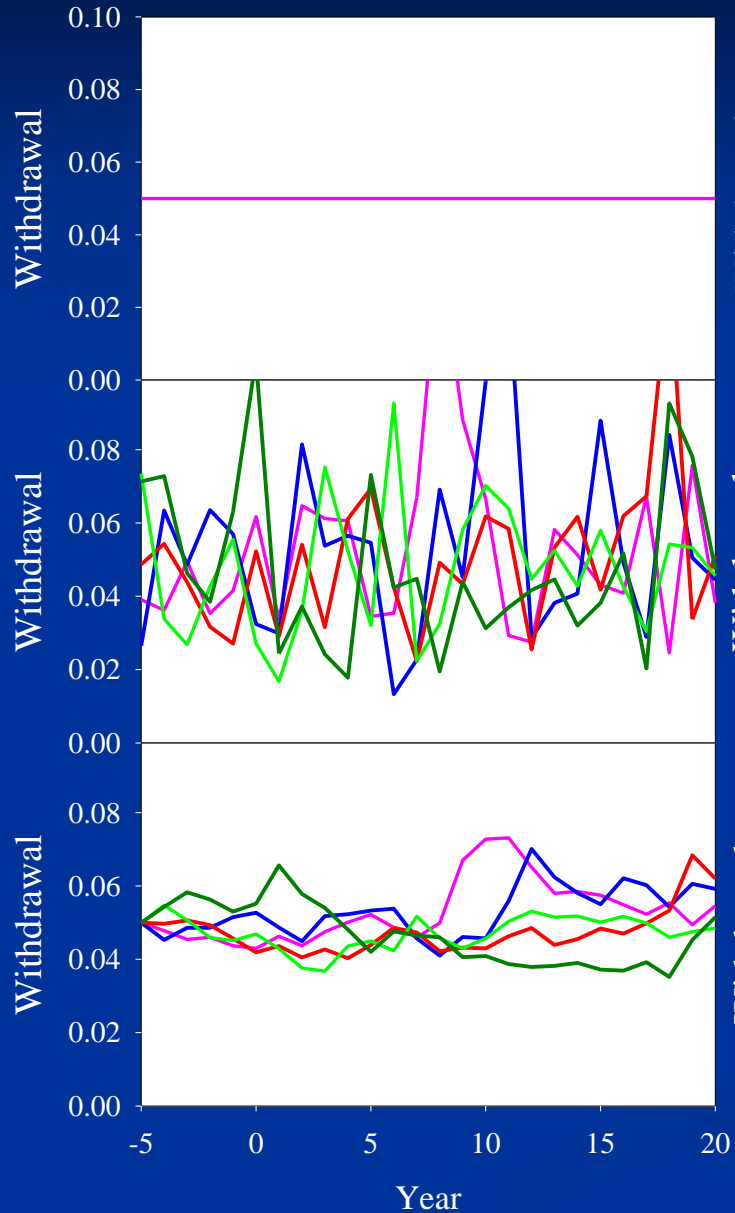
II

III

Annual Withdrawal

No theft

Theft



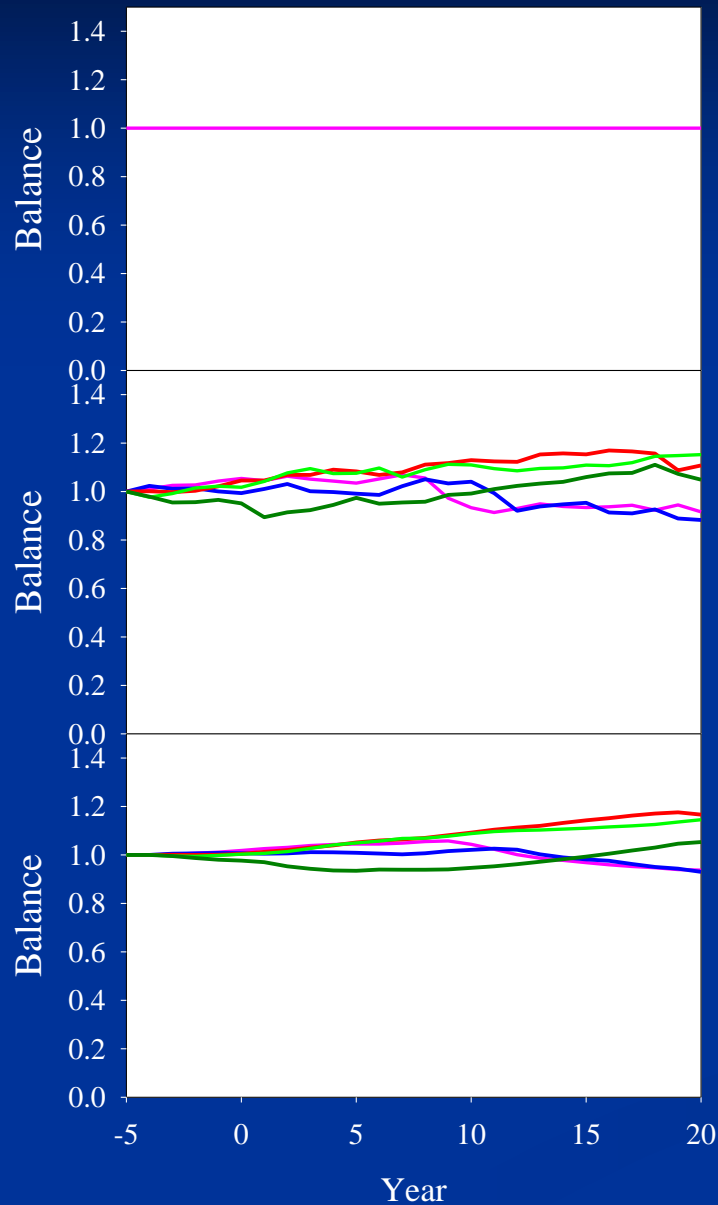
I

II

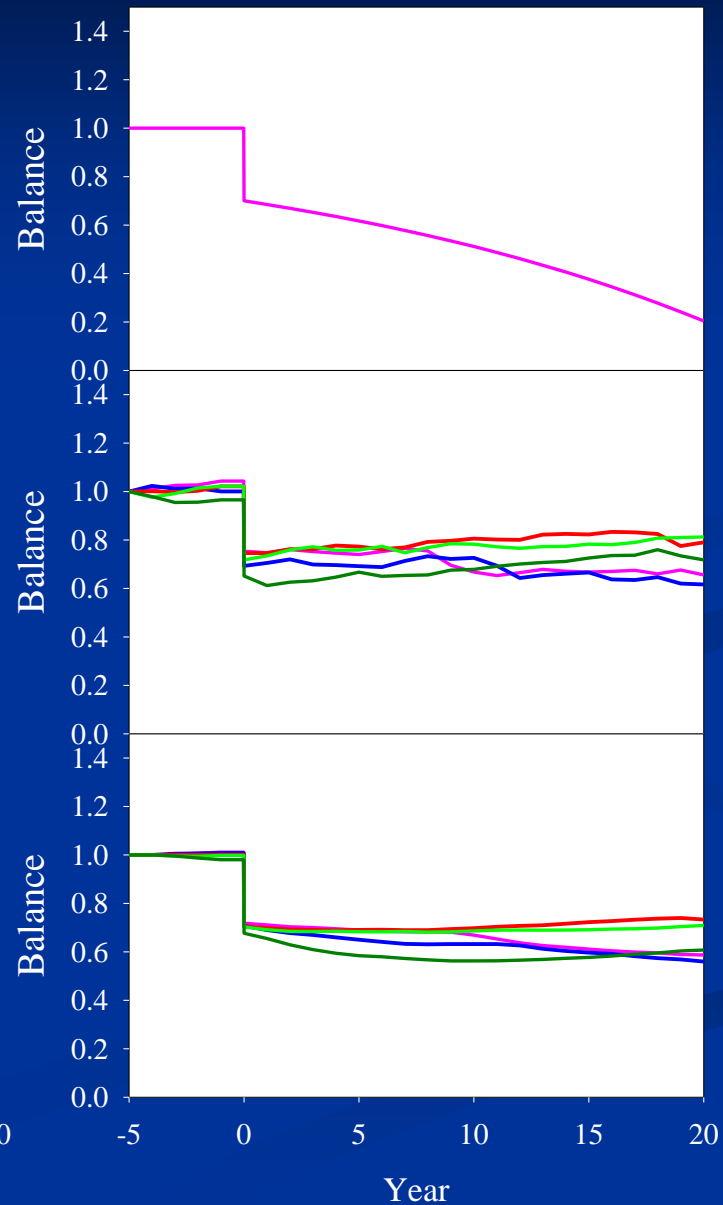
III

Balance in Account

No theft



Theft



I

II

III

PERFORMANCE

- I:** Going bankrupt if theft occurred
- II:** Stabilises balance in account, but annual withdrawals too variable
- III:** Best of the three – stabilises balance without too much change from year to year

Formula III automatically corrects for effect of recruitment failure/IUU fishing if it occurred.

“Feedback control” (MP basis)

THE MANAGEMENT PROCEDURE APPROACH (MSE)

NOTE: ANDRE WILL EXPLAIN FURTHER

- 1) Specify alternative plausible models of resource and fishery (Operating Models – OM_s)
- 2) Condition OM_s on data (effectively alternative assessments); pre-specify future data inputs to MP
- 3) Agree performance measures to quantify the extent to which objectives are attained
- 4) Select amongst candidate MP_s for the one showing the “best” trade-offs in performance measures across objectives and different OM_s in simulation testing

SO WHAT EXACTLY IS AN MP ?

- Formula for TAC recommendation
- Pre-specified inputs to formula

But isn't this the same as the traditional
approach ?

Almost, but not quite

So what's the difference ?

- a) Pre-specifications prevent haggling
- b) Simulation checks that formula works even if “best” assessment wrong

How is the MP formula chosen from amongst alternative candidates ?

- a) Compare simulated catch / risk / catch variability trade-offs for alternatives
- b) Check adequate for plausible variations on “best” assessments

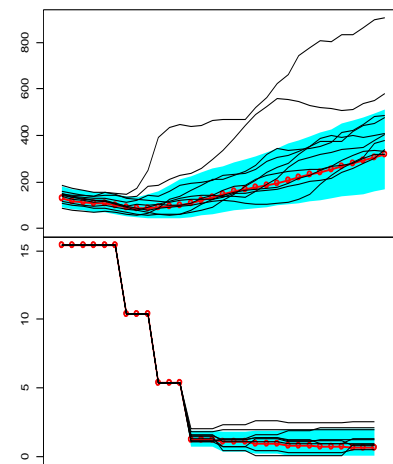
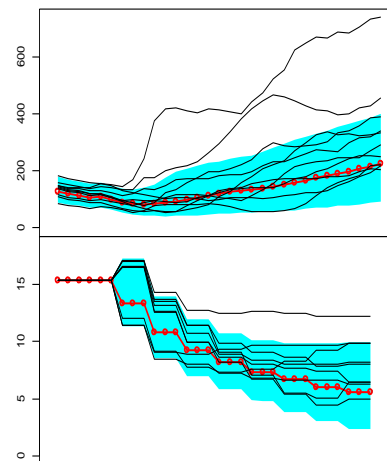
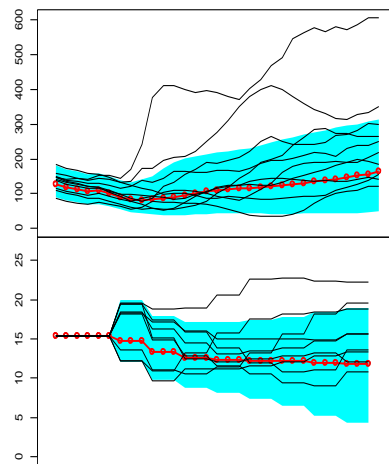
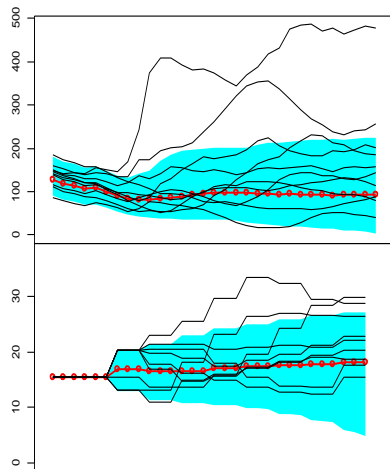
SOUTHERN BLUEFIN TUNA EXAMPLE

TRADE OFF

←
More catch

→
More recovery

Catch Biomass



Year

Different HCR options

What are the advantages of the MP approach ?

- a) Less time haggling of little long term benefit
- b) Proper evaluation of risk
- c) Sound basis to impose limits on TAC variability
- d) Consistent with Precautionary Principle
- e) Provides framework for interactions with stakeholders, particularly re objectives and trade-offs amongst them
- f) Use haggling time saved towards more beneficial longer term research

What are the disadvantages of the MP approach ?

- a) Lengthy evaluation time
- b) Overly rigid framework (though 3-5 yearly revision)

BUT

Provides default

When should scientists change the TAC recommendation from a MP?

New information / understanding shows actual resource situation is outside range tested

A MP is like an auto-pilot

BUT

The real pilot remains to check that nothing unanticipated has occurred (i.e. annual routine assessments continue)

How should managers react to MP-based scientific recommendations ?

- a) Treat as default (replacing “no change”) so that necessary action is not delayed
- b) Require compelling reasons to change i.e. such a decision should not be taken lightly

III. WHEN SHOULD MSE BE IMPLEMENTED?

Scenario A

- A large quantity of non-conflicting data covering a few decades
- An agreed assessment giving estimates of high precision
- Few serious uncertainties about assessment assumptions
- Little argument about the TAC recommendation to follow from the assessment

No urgency to implement MSE

ARE YOU IN UTOPIA OR DENIAL ??!!

III. WHEN SHOULD MSE BE IMPLEMENTED?

Scenario B

- Few data
- Perhaps an historical catch series (accuracy questionable)
- No more than a rudimentary:
 - i) Estimate of abundance in absolute terms; or
 - ii) Very short series of a relative abundance index

USE A PRECAUTIONARY DATA-POOR METHOD TO PROVIDE ADVICE

Focus first on developing an improved index of relative abundance before considering MSE

III. WHEN SHOULD MSE BE IMPLEMENTED?

Scenario C (Minimally — do any NP tuna stocks match this profile?)

- Historical catches, with some idea of their accuracy
- A relative abundance index good and long enough plus sufficient biological information to develop at least a simple assessment
- Nevertheless assessment results that vary considerably depending on assessment (and data) assumptions that are under debate/dispute
- Reasonable certainty that the abundance index will continue to be available for each coming year

IMPLEMENT MSE

ABUNDANCE INDEX/INDICES

North Pacific albacore – representative series

Juveniles - Japanese pole and line CPUE

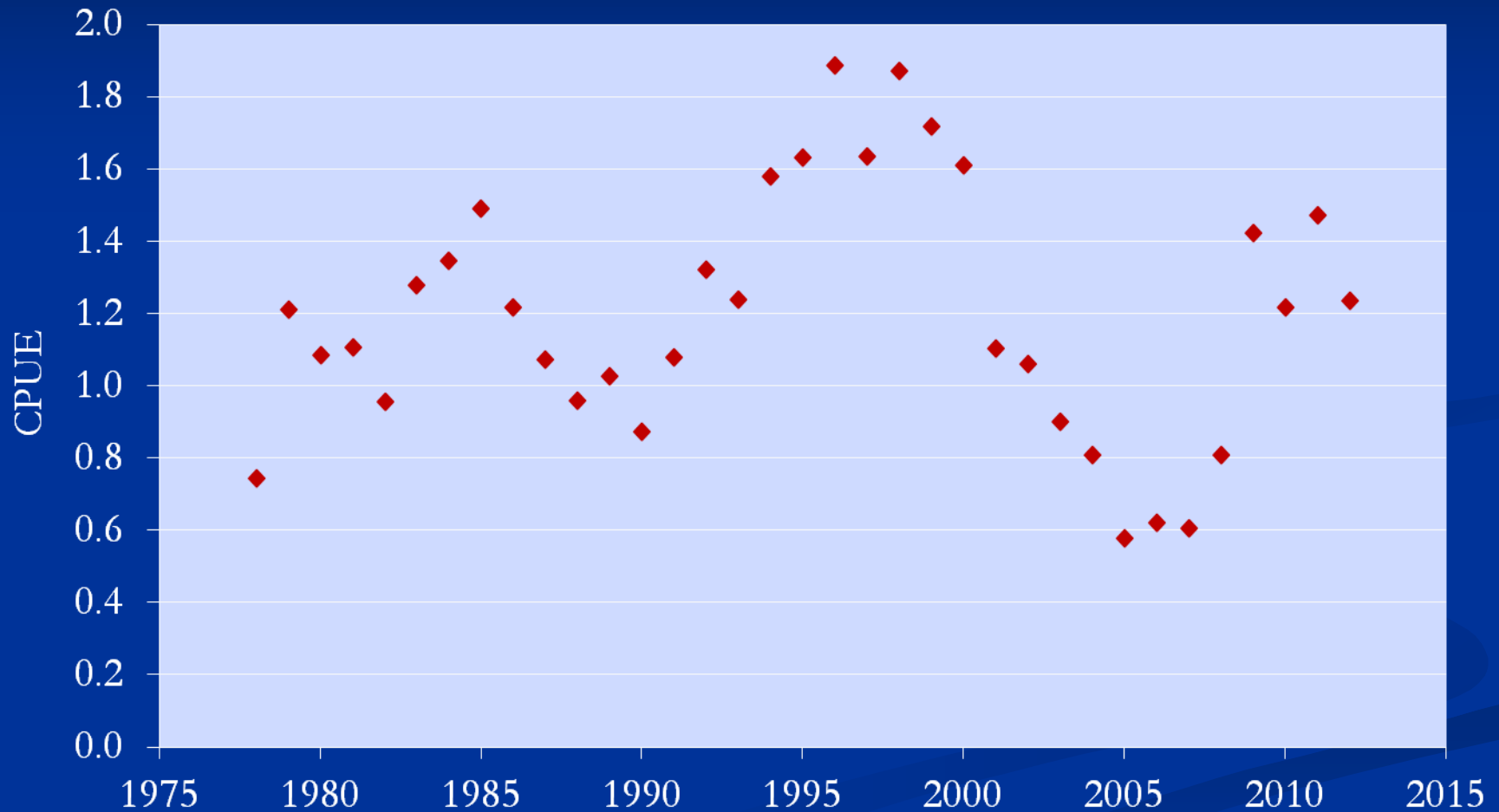
Adults - Japanese longline CPUE

MSE simulation testing needs

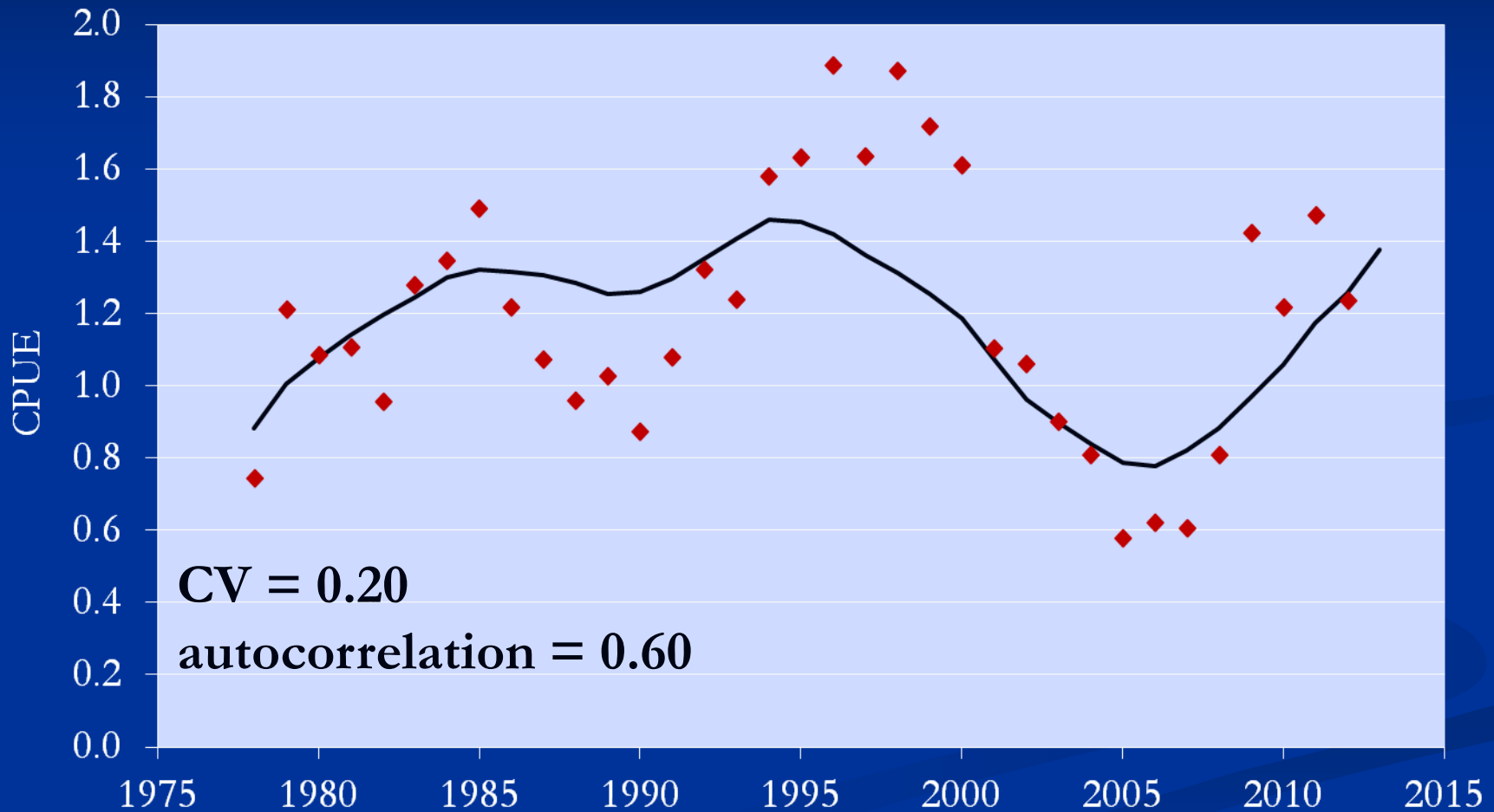
Not only such series continuing

But also the extent of their variability about the true underlying abundance trend

SOUTH AFRICAN DEEPWATER HAKE – SOUTH COAST CPUE - DATA



SOUTH AFRICAN DEEPWATER HAKE – SOUTH COAST CPUE – MODEL FIT



IV. SHORT LIVED SPECIES

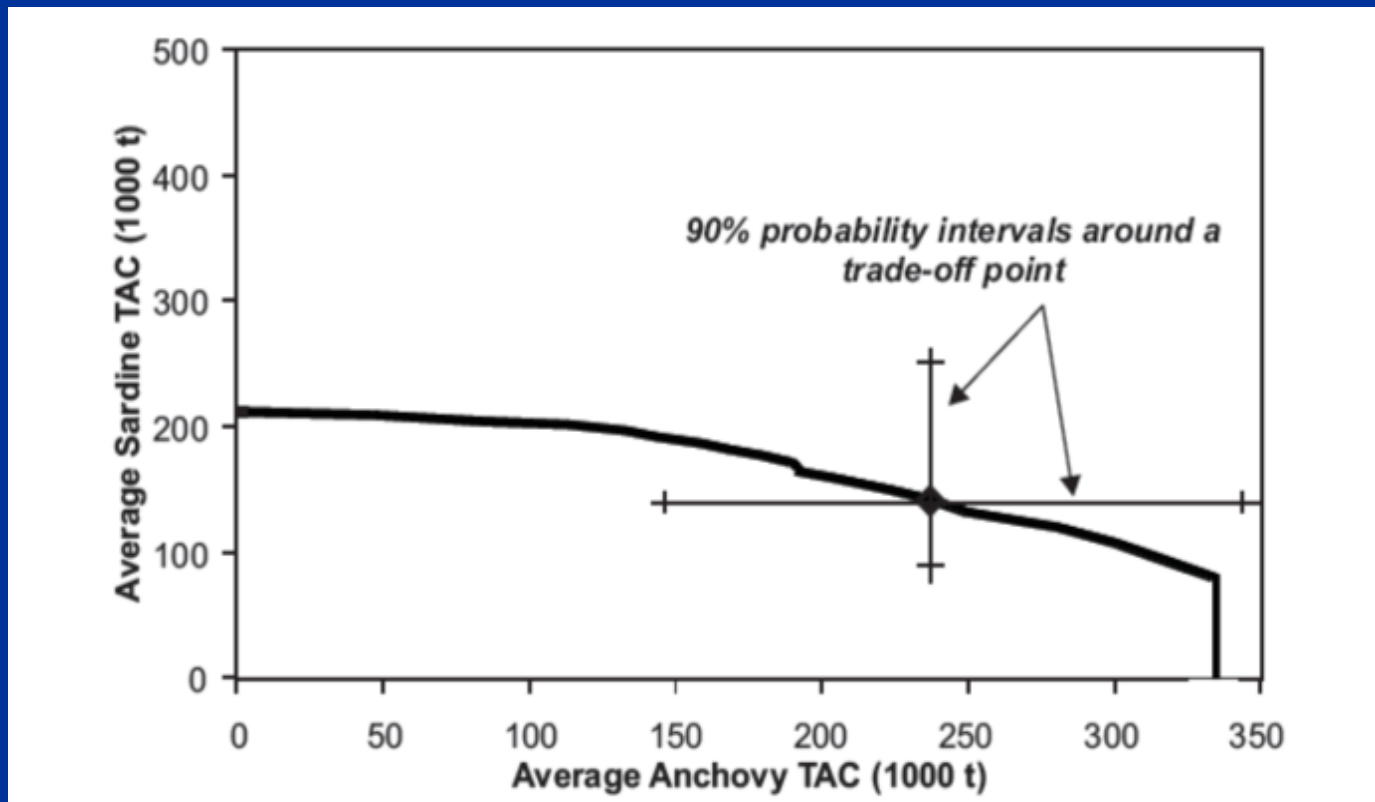
- MSE remains applicable, despite large fluctuations in abundance
- However focus on attaining a target abundance tends to be dropped
- Rather the emphasis is on minimising the probability of abundance falling under some threshold below which average recruitment might be appreciably reduced

SOUTH AFRICAN SARDINE AND ANCHOVY

TAC formulae are variants of constant proportions of annual acoustic survey abundance estimates

Trade-off as juvenile sardine caught with anchovy

Options ensure low probability abundance < threshold



Thank you for your attention

With thanks for assistance with slides to:

Carryn de Moor

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