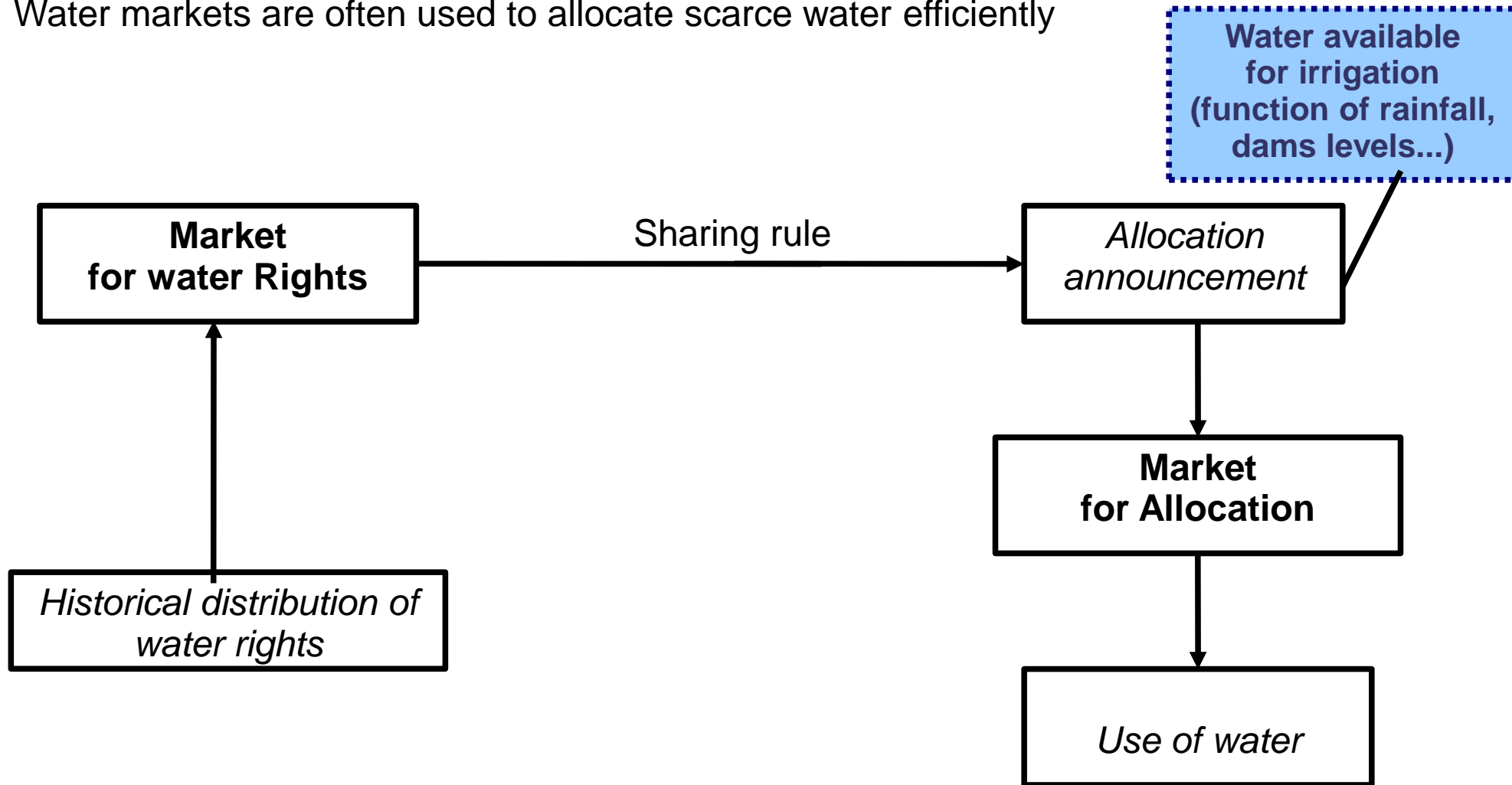


Impacts of security of water rights on water markets: Experimental evidence

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Motivation

Water markets are often used to allocate scarce water efficiently



Motivation

Objective: Efficient Water allocation under

Uncertain water availability

How to design water markets
(*water rights* + allocation market)

- to allocate the available water efficiently and cost-effectively
- to share the risk faced by farmers concerning their water allocation (allocate risk efficiently)

Research Question

- Regulators can influence the performance of water markets through market design.
- Efficiency and risk management can be affected by the: **Security of water rights.**
- We are interested in examining two security schemes that lead to different rules for sharing water: **identical rights Vs differentiated rights.**

Security of water rights: an example

One feature of market design: sharing rule

Proportional – one level of security (South Australia, Chile, Mexico)

	Volumetric right	Allocation announcement	Allocation
Farmer 1	20 ML	40 ML	$20/80 \times 40 = 10 \text{ ML}$ (50%)
Farmer 2	60 ML		$60/80 \times 40 = 30 \text{ ML}$ (50%)

Priority – two levels of security (Victoria, NSW, West USA)

	Volumetric right	Allocation announcement	Allocation
Farmer 1	20 ML high security	40 ML	20 ML (100%)
Farmer 2	60 ML low security		$40 - 20 = 20 \text{ ML}$ (33%)

	Volumetric right (portfolio)	Allocation announcement	Allocation
Farmer 1	10 ML high security 10 ML low security	40 ML	10 ML (100% + 0%)
Farmer 2	30 ML high security 30 ML low security		30 ML (100%+0%)

Rationale for 2 security levels

+	-
<p>Better mapping of preferences → Less costly transactions required on the spot market</p> <p><i>Freebairn and Quiggin (2006)</i></p>	<p>Additional costs for the water authority</p> <p><i>Management of Irrigation Water Storages, ABARE, 2009</i></p>
<p>Better risk management</p> <p><i>Howitt (1998), Calatrava and Garrido (2005), Cristi (2007)</i></p>	<p>Additional costs for irrigators</p> <ul style="list-style-type: none">● Define efficient portfolio of rights● Need for more trade on the water rights market● Transaction costs in water and environmental markets <p><i>Freebairn and Quiggin (2006), Brennan (2006), Cason and Gangadharan (2003)</i></p>

What are the gains from a differentiated system? Under what conditions would we observe these gains in the lab?

Experimental design - Treatments

Levels of security

1 (general security)	2 (high and low security)
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C1

C2

S1

S2

Transaction
costs

TC allocation market

TC rights market

Transaction fee: 2 E\$ per unit traded



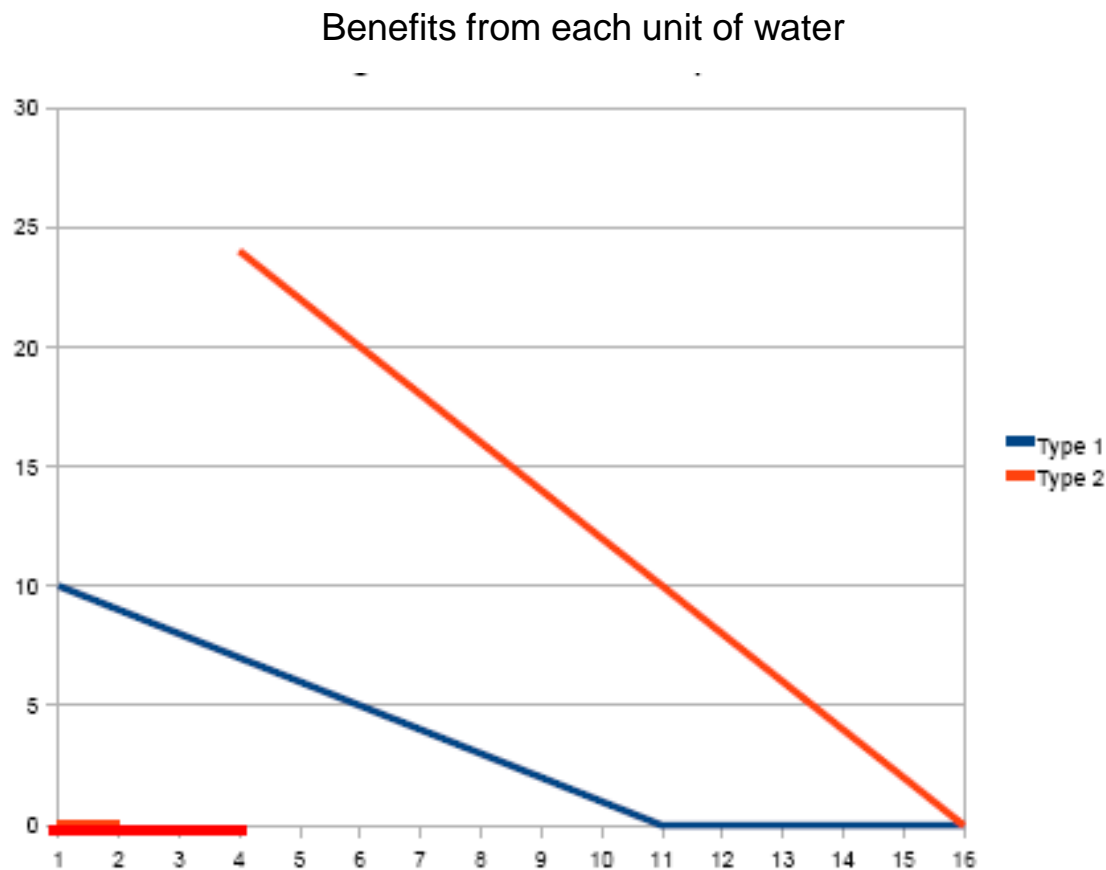
Increases performance ?

Experimental procedure - Types

6 subjects participate in each market.

There are 3 Type 1 subjects and 3 Type 2 subjects:

- Type 1 (mixed-crop: low value, high elasticity of demand)
- Type 2 (horticulture: high value, low elasticity of demand, minimum requirement)



Procedure

Experiments conducted at the University of Montpellier.

Subjects participated in an individual lottery task:

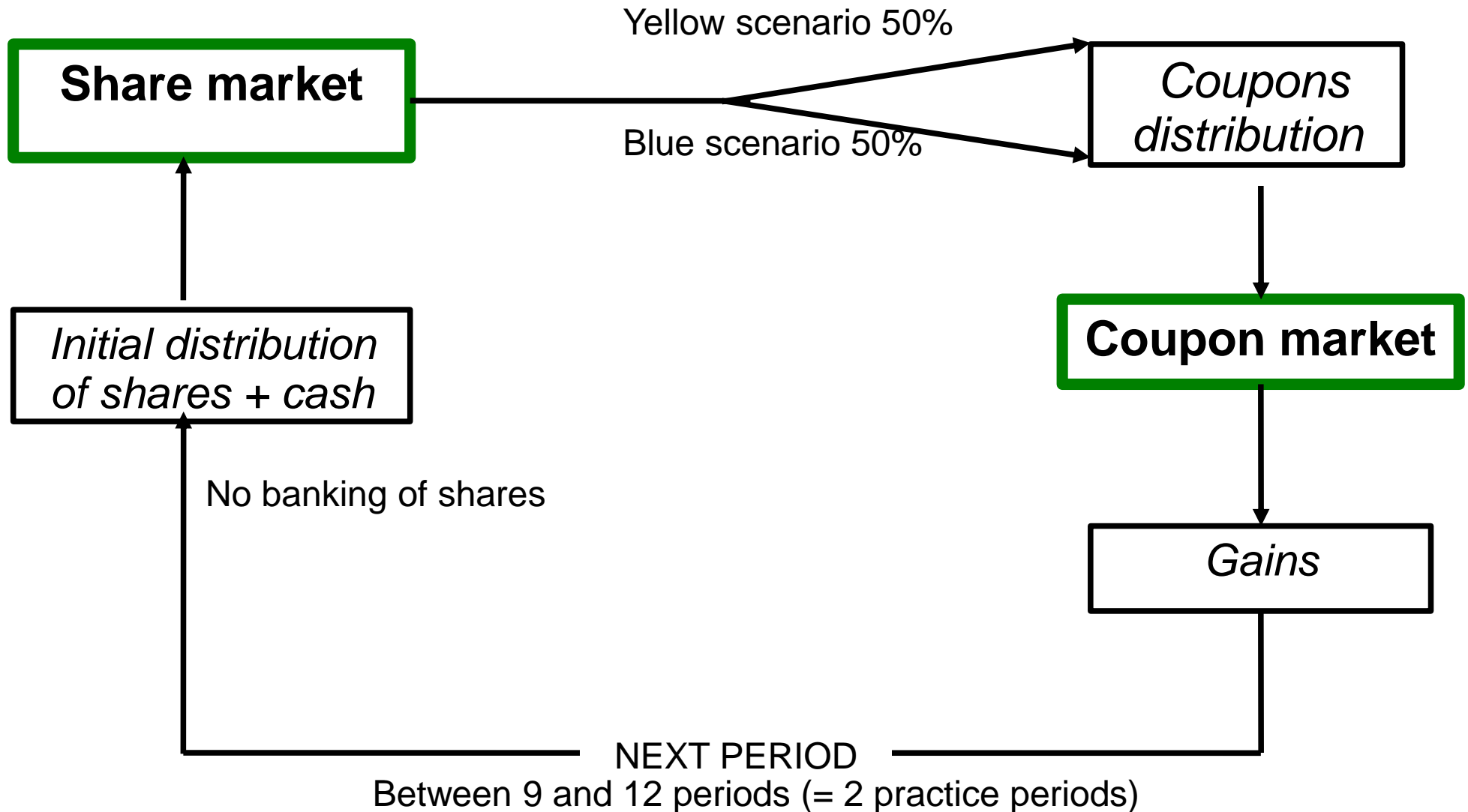
- elicit risk preferences.

Neutral terminology used:

- water rights are called shares
- water allocations are called coupons.

Experimental design - Game

Game



Experimental design – Trading mechanism

Continuous Double Auction (2 minutes)

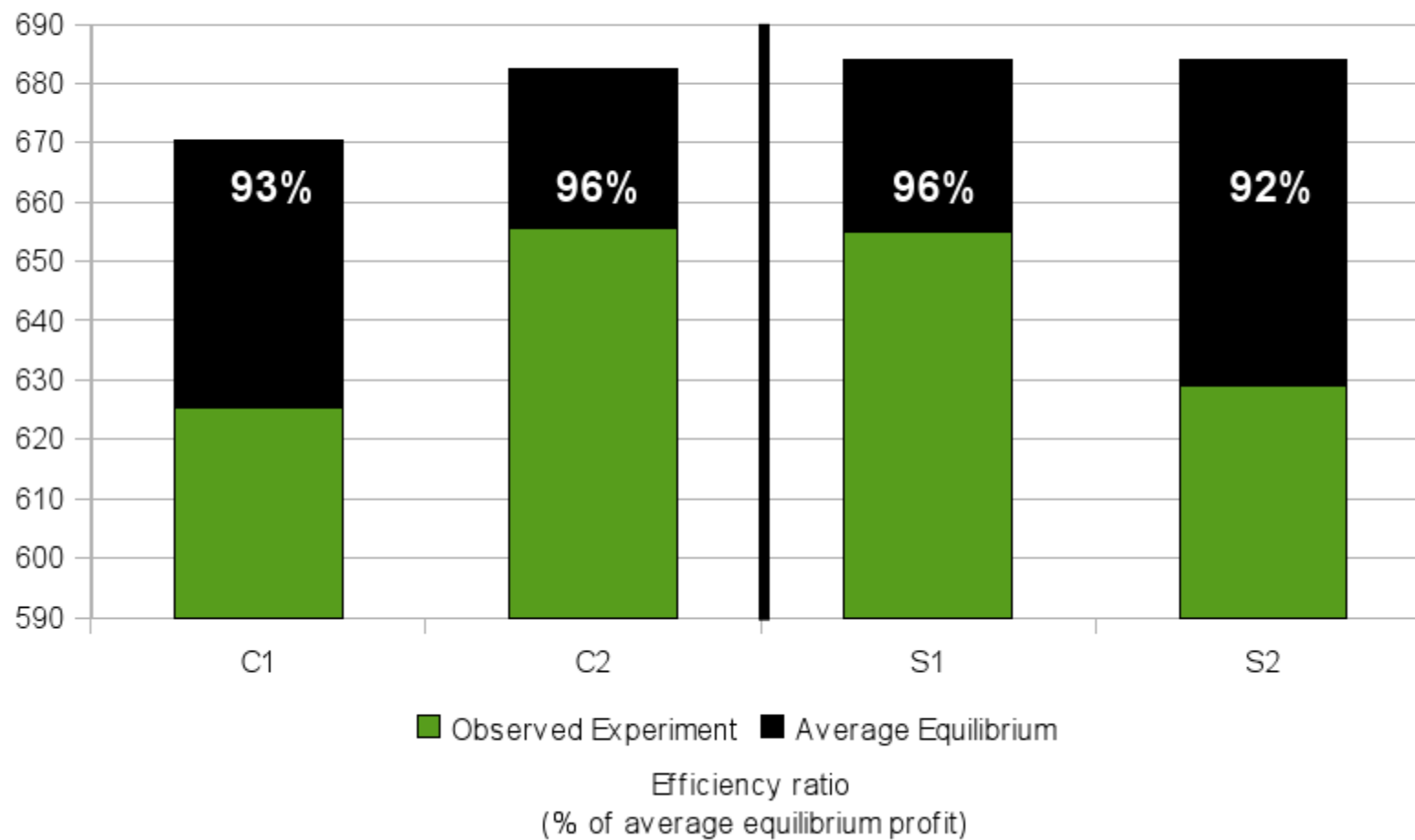
Period 1		Remaining time [sec]: 59			
Cash: 100 Shares you hold : 9	Stage 1: Share market				
Number of coupons you receive from 1 share Yellow Scenario: 0.33 Blue Scenario: 1.0	Sell offer <input type="text"/>	Sell offers	Trade prices	Buy offers	Buy offer <input type="text"/>
		<input type="text"/>	<input type="text"/>	<input type="text"/>	
	<input type="button" value="Make offer"/>	<input type="button" value="Buy Shares A"/>		<input type="button" value="Sell Shares A"/>	<input type="button" value="Make offer"/>

Hypotheses

- **Hypothesis 1:** A differentiated system increases profits (more so for C1 vs C2).
- **Hypothesis 2:** The allocation of risk is improved with a differentiated system (type 2 bears less risk)
- **Hypothesis 3:** Subjects deviate more from equilibrium (portfolio of shares and coupons, profits) with a differentiated system (due to complexity), thus reducing the effective performance of the system

Results

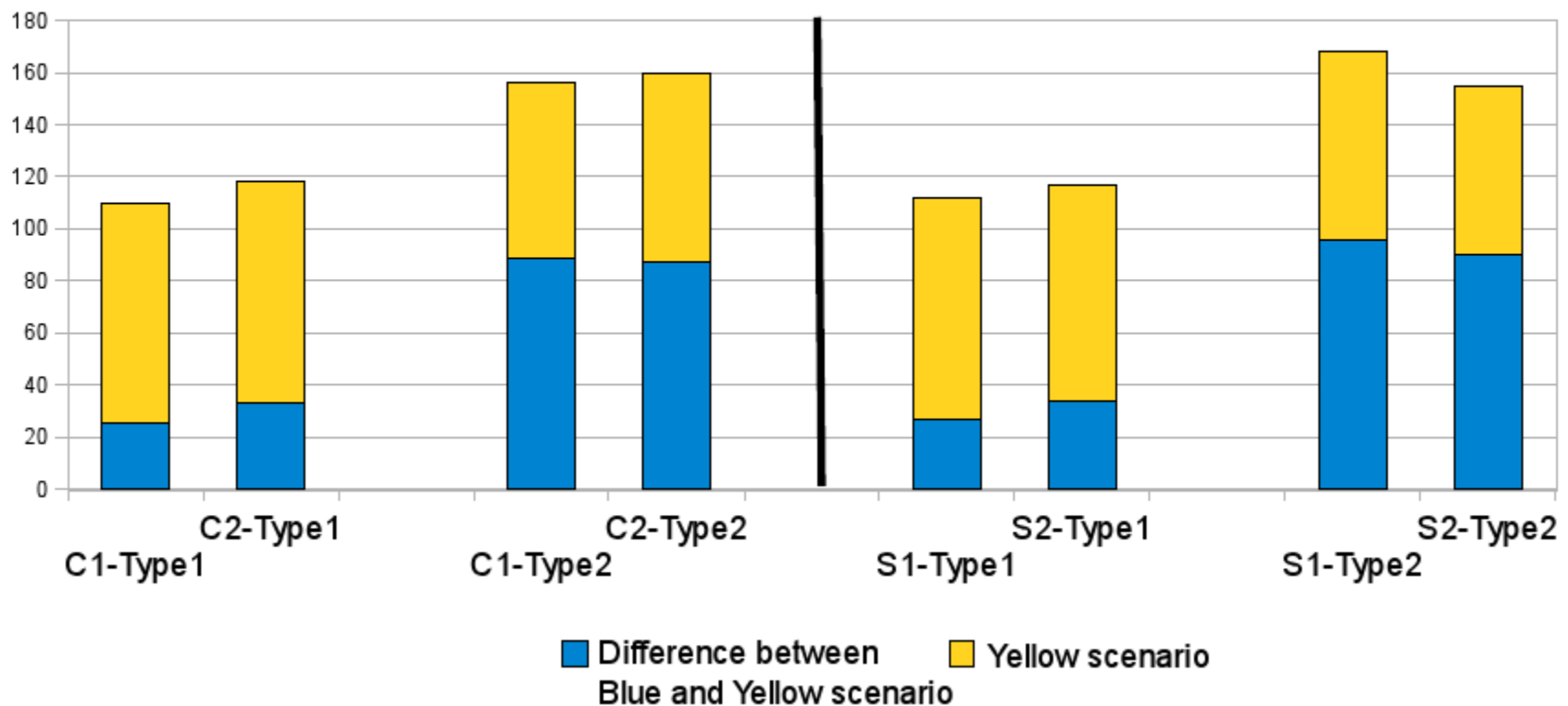
Total profits in a 6-subjects group
Average over the last 4 periods



Results

Variability of profits between scenarios

Average over the last 4 periods



Summary of Results

Hypotheses	C2 vs C1	S2 vs S1
H1: Increased Profits	Supported	Not Supported
H2: Improved Risk Allocation Between Types	Supported	Supported (Not Significant)
H3: Lower Efficiency	Not Supported	Supported

Conclusion

Objective: We focus on the performance of one specific water market feature: **security of** water rights.

- In terms of risk allocation: a differentiated system performs better.
- For profits and efficiency: **transactions costs** are relevant:
 - if these costs are more in the allocation markets than the rights markets (C2), then the differentiated system can also increase total profits.
 - However if it is more costly to trade rights than allocation (S2), then the benefits are much less.
 - Is there then a trade off between water allocation and risk allocation?