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Water management options for the Middle Drâa River Basin

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Overview

1. Problem: increasing water scarcity
2. Water management and pricing
3. Scenarios of source-dependent water pricing
4. Conclusions and outlook

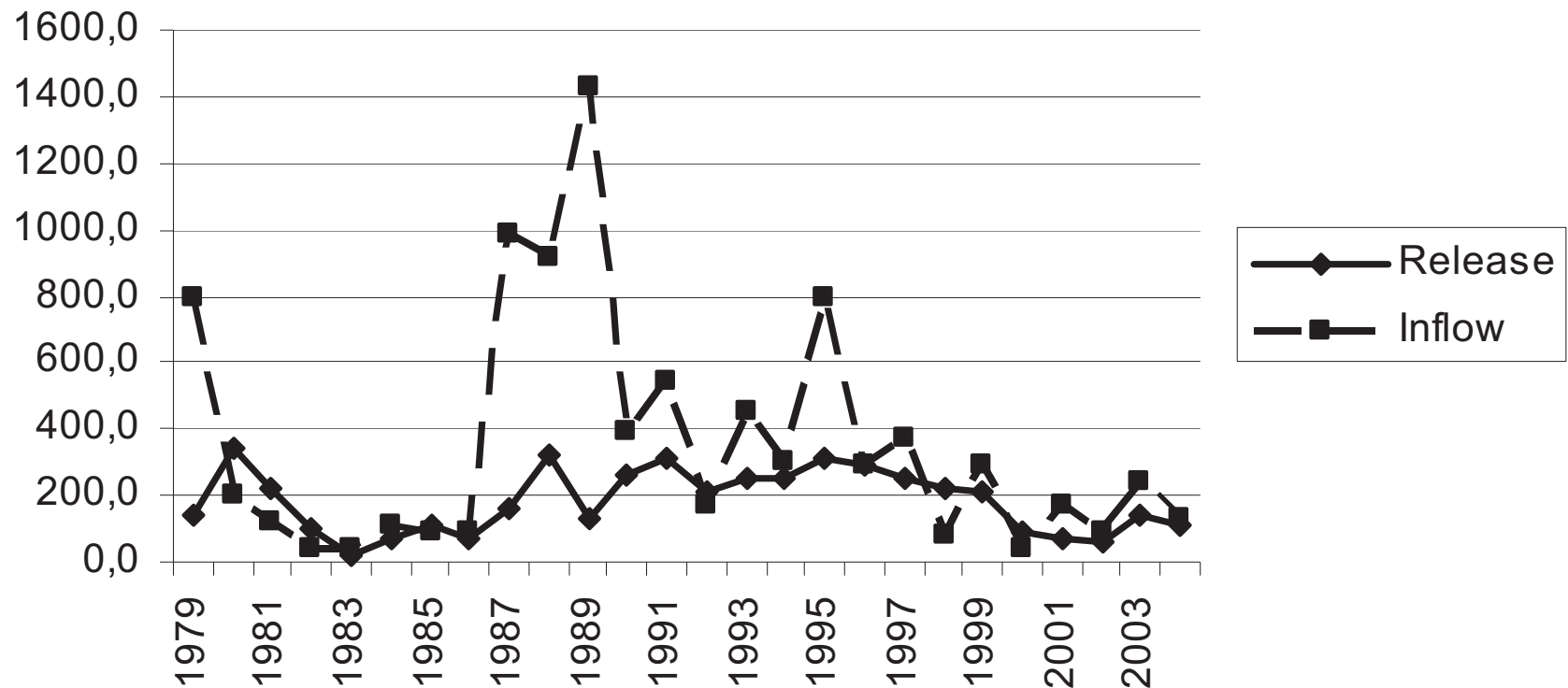


Water-related problems

- Highly volatile availability of surface water, declining trend
- More use of groundwater for irrigation
- Increasing problems with salinity
- Competition from non-agricultural users (minor problem!)



Water balance of the Mansour Eddhabi dam (mio cbm)



- High **volatility** of water supply
- Droughts of up to a **decade** well possible ...



Gross water storage capacity in the Drâa valley

	1972	2000	2020
Total reserves in mio cbm	918	797	725
Reservoir	61%	55%	51%
Aquifers	39%	45%	49%

- Siltation of the reservoir, high evaporation losses
- Increasing role for groundwater as buffer
- Needs for irrigation: 320 Mio cbm in a normal year



Research tasks

- Consider conjunctive use of water resources within numerical simulation models
- Develop long-term scenarios on the basin scale
- **Simulate water management options, among them water pricing**
- **Goals of water management:**
 - **Stabilisation of farm incomes**
 - **Preservation of groundwater resources**



Water pricing in Morocco and the Drâa region

- Pricing of surface water in most irrigation perimeters
- Price levels mostly below costs of water provision
- No pricing of groundwater use
- In the **Drâa region**, no water pricing at all
- Local distribution of surface water according to historical farming areas and customary water rights



Assumptions behind the scenarios:

- Unfolding drought with a continuous reduction of surface water (-14% annually)
- Perfect knowledge of resource availability for the current year, no foresight for future years
- Costs of pumping groundwater: 0.58 MAD/cbm
- Rules for water distribution among the Drâa oases
- No quality differences between surface and groundwater



Scenarios of water pricing

1. Base run

2. 'SWC'

=> Pricing only surface water at 1 MAD/cbm

3. 'GWC'

=> Pricing only groundwater at 1 MAD/cbm
(+ 0.58 pumping costs)

4. 'TWC'

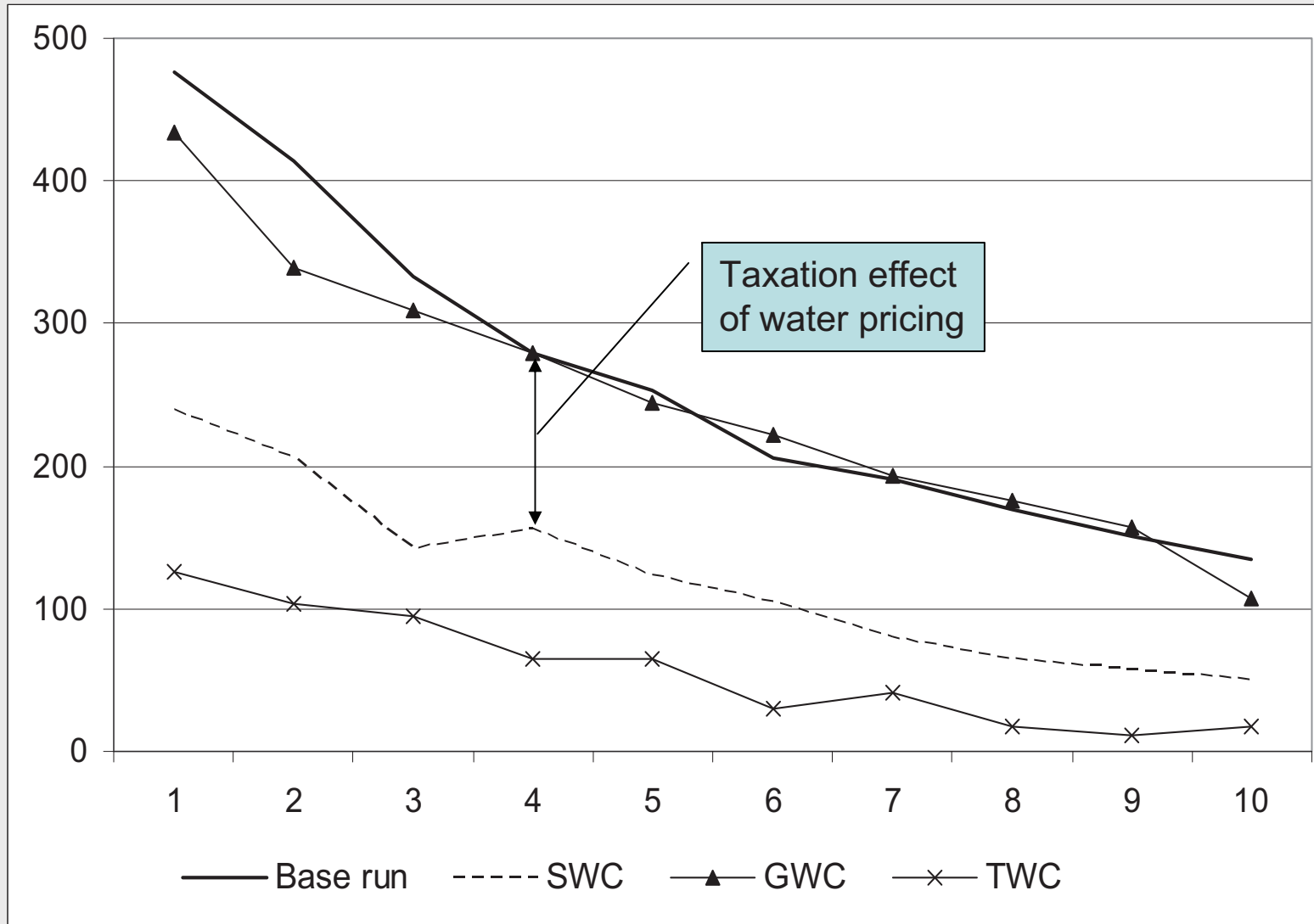
=> Pricing both surface and groundwater at 1 MAD/cbm



A comparison of scenarios: Averages of key variables across 10 years

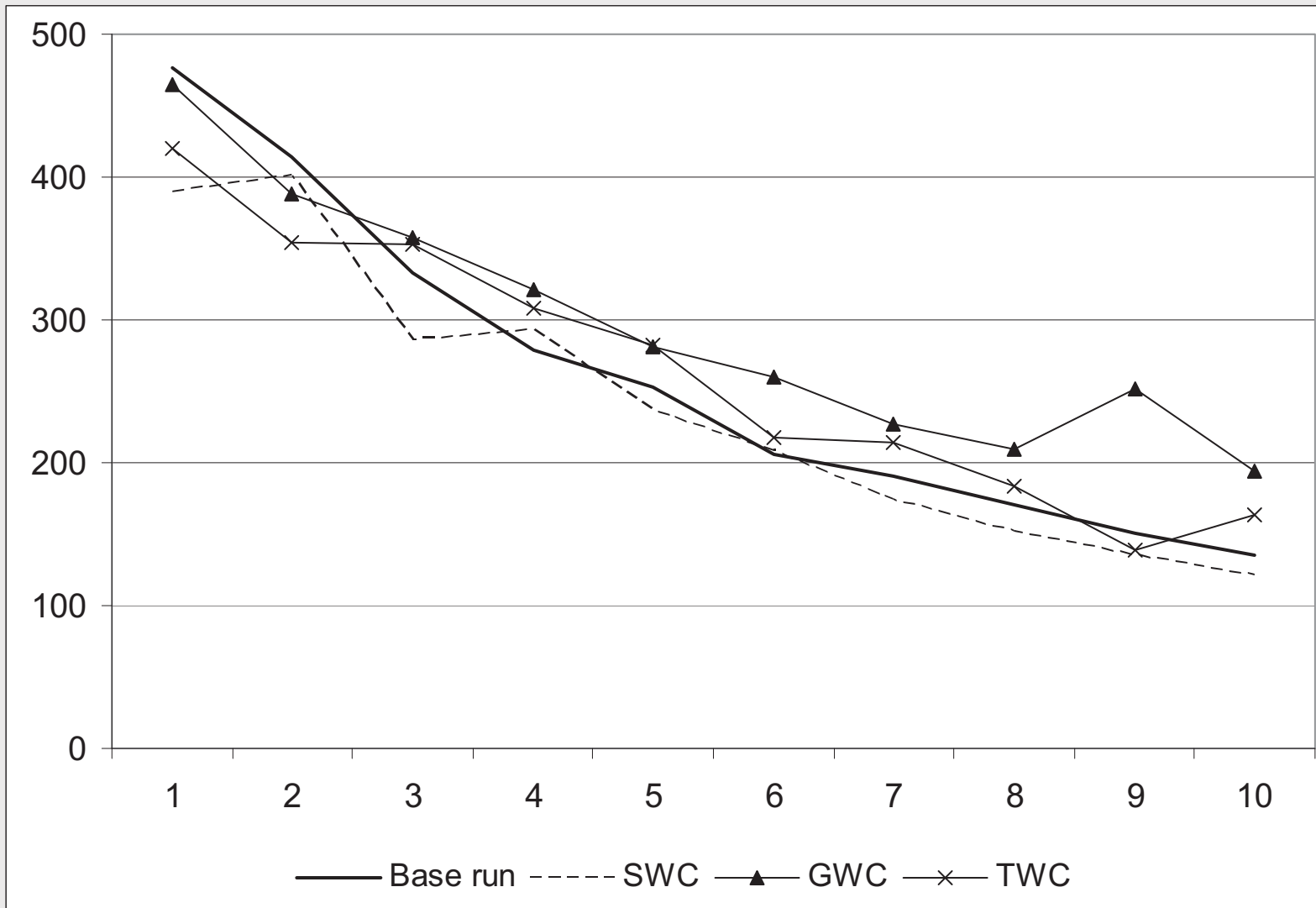
	Base run	SWC	GWC	TWC
Agric. river water use (mio cbm)	123.0	117.0	151.0	137.0
Agric. groundwater use (mio cbm)	86.0	92.9	49.4	66.3
Water shadow price (DH/cbm)	2.5	2.5	2.3	2.3
Agricultural net revenues (mio DH)	260.8	122.2	246.2	57.2
Sum of water charges (mio DH)	0.0	117.4	49.2	206.3
Total basin revenues (mio DH)	260.8	239.6	295.4	263.5
Agric. net revenues (disc. at 10 %)	196.0	93.7	183.1	45.6
Total basin revenues (disc. at 10 %)	207.3	189.9	214.6	194.9

Net agricultural revenues over 10 years, Mio MAD



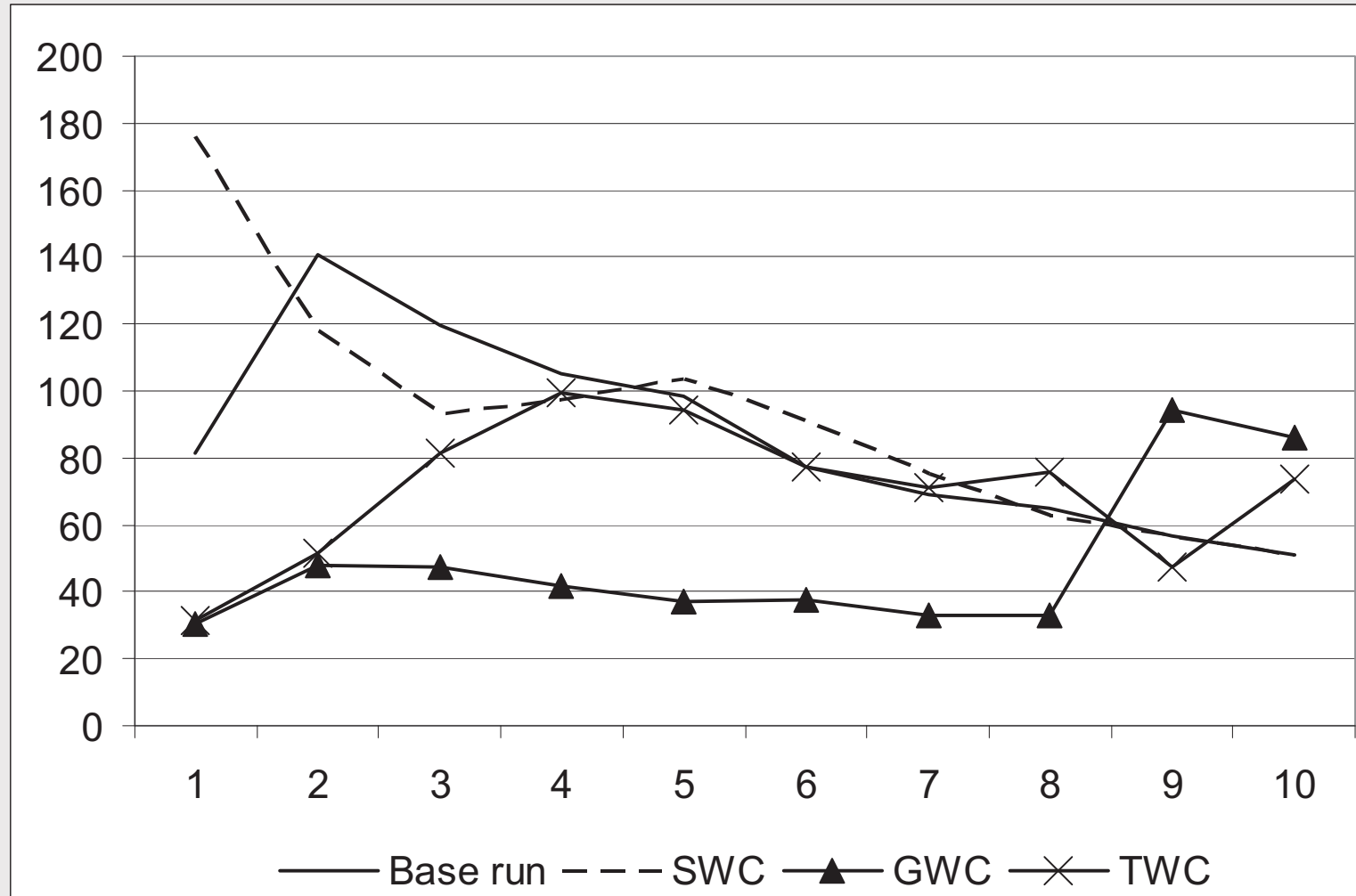


Net basin revenues in Mio MAD over 10 years (incl. water charges)





Groundwater use in different scenarios over 10 years, Mio cbm

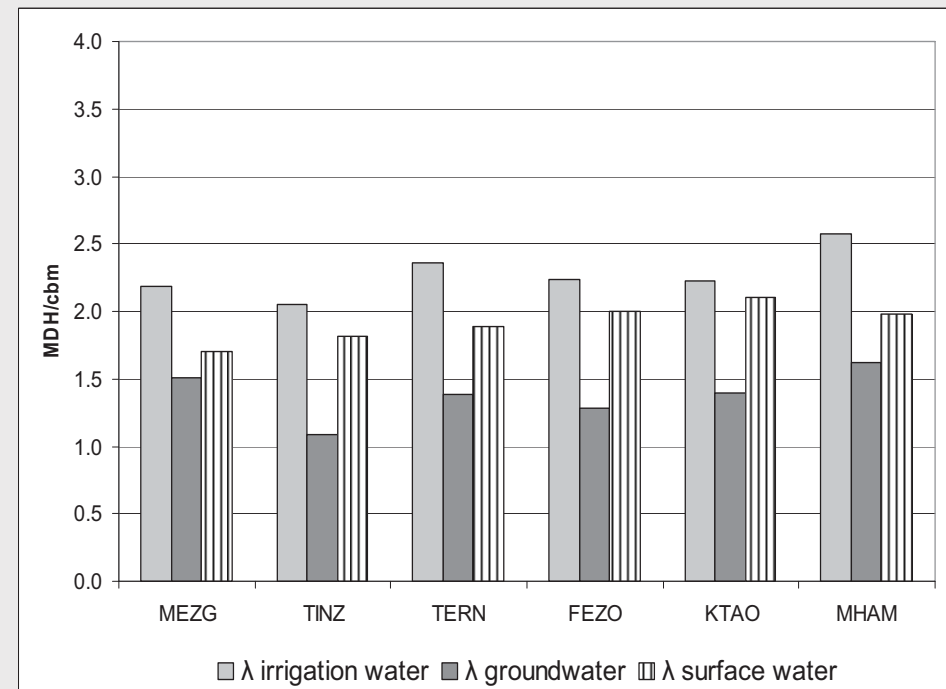
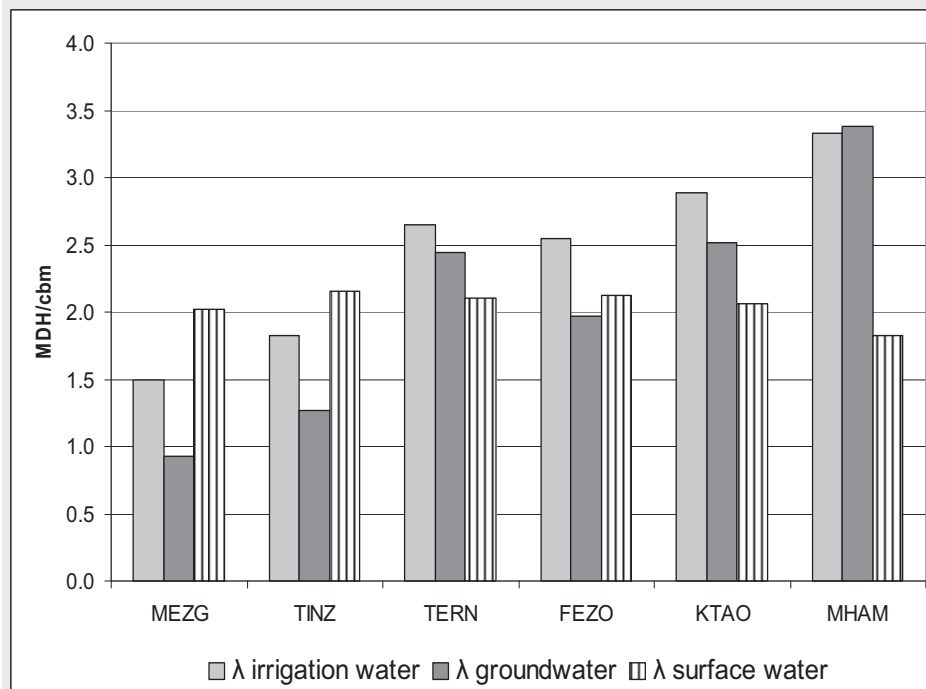




Water shadow prices in oases, ten-year averages

Base run

Groundwater pricing



More even distribution of water scarcity across locations



Conclusions

- Groundwater pricing seems worth considering:
 - incomes are stabilised over time
 - groundwater resources are preserved
 - the taxation of farmers is comparably mild
 - basin-wide revenues higher than without pricing
- Groundwater quantity and quality may improve => positive external effects
- Results demonstrate attractiveness of aquifers as buffers
- Pricing of surface water aggravates groundwater mining



Water pricing: questions of implementation

- Political feasibility
 - Interference with local customs
 - Structural change cannot be avoided completely
 - Economic benefits may not be worth the political price
 - Should charges for water use be compensated?
- Costs of implementation and compensation
 - Monitoring individual use vs status of the local aquifer?
 - Rule out private pumping to ease monitoring?
 - Should charges finance investments?
- Transaction costs
 - New administrative structures needed?
 - Communal or individual liability for overuse of water?



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Additional information

Documentation:

<http://www.ilr1.uni-bonn.de/agpo/rsrch/impetus/doc/mivad-docu.pdf>

Website IMPETUS Morocco at ILR:

http://www.ilr1.uni-bonn.de/agpo/rsrch/impetus/impetus_e.htm