Economic Analysis of Policy Options for Solving Water Challenges

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1. Scope of Policy Relevant Research

2. Current Research

3. Opportunities at the Water Resources Research Center

Scope of Applied and Ongoing Research

- Analyze Public and Private Incentives for Management of Water and Other Natural Resources Internationally and Locally

- Strategies by International Institutions to Address Transboundary Water and Air Pollution

- Trade Policy Linkages and Implications for solving dynamic and asymmetric damages and costs of shared waterway and airshed pollution at international borders

- Policies to address two major threats to biodiversity -habitat alteration and invasive species through vectors of trade and transportation in waterways and shipped commodities.

- Policies for optimal energy and mobile fuel sources

Current Research

- Comparing institutions for water improvement on the U.S.-Canada and U.S.-Mexico borders

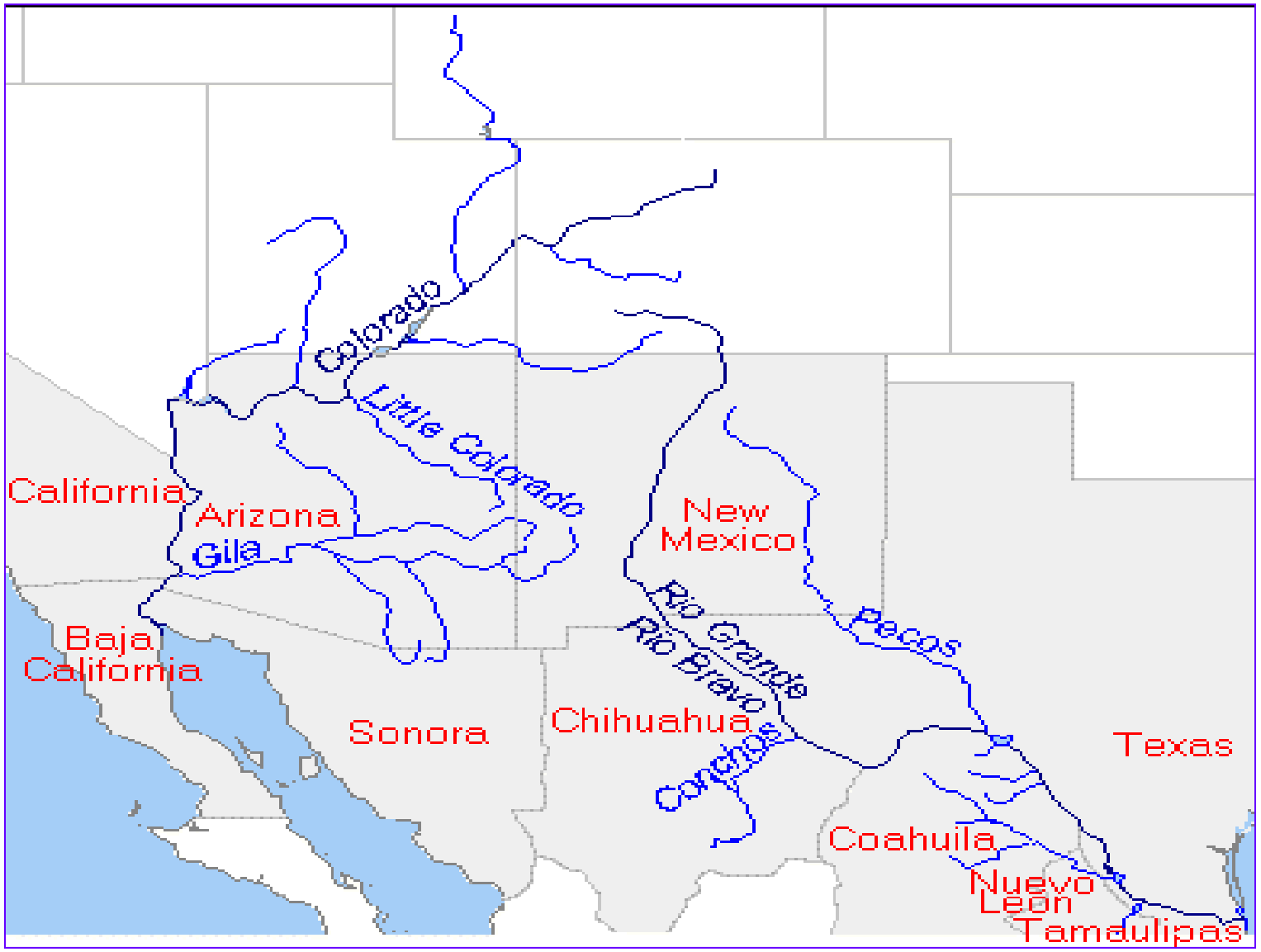
- Dynamic and spatial analysis of watershed and habitat preservation policy impact on residential land values-Desert landscapes

- Options for preventing invasive species and heavy metal contamination from boating in shared waterways (wetlands)

- Analysis of technical assistance and policy by the World Trade Organization to prevent invasive species in traded commodities between North America and the rest of the world

Shared Watersheds and Airsheds on Borders in North America

US-Mexico Border Map



Economics of Transboundary Water Pollution

- Study water pollution solution on shared borders through game theory comparing options for countries to match management (financial flow and stock) to hydrologic system.

- Cooperation: countries jointly finance pollution control.
  Noncooperation: countries finance alone.
  Stackelberg: one country leads effort.

- Asymmetric incentives across countries (different pollution control costs, flow and stock effects, ability to pay, damages)

Integrated Model Components –with multiple decisionmakers acting simultaneously

- Objective: minimize costs of pollution control and damages due to wastewater pollution
- Pollution: Equation of wastewater over time and space with transport from upstream to downstream

Comparing Financial Strategies along U.S.-Mexico and U.S.-Canada borders for shared water problems

- International Joint Commission – each country has own office (like IBWC) and jointly finances environmental monitoring, data management and dissemination for each binational watershed along U.S.-Canada border-each country negotiates over local problems.

- Border Environmental Cooperation Commission (BECC)- 5 members from U.S. and 5 from Mexico certify projects and provide technical assistance to border cities for project development

- NADBank-binational bank equally capitalized with 5 members from the U.S. and 5 from Mexico that finance environmental projects certified by BECC

- U.S. EPA grants through four funds of NADBank and one fund in BECC program
  $877 million in grants and $1.2 billion in loans for border projects (2011)

Findings thus far

- Cooperation across binational watersheds minimizes costs, damages, and stock of wastewater pollution; Stackleberg ranks second

- Investment initially followed population share in terms of allocation. Recently, a shift to hydrological area and land area. (Parallel to International Law Association's Helsinki Rule) Ex. February 2011, wastewater projects in the Tijuana watershed

- For the southern border, the analysis reveals projects that generate employment opportunities are certified and financed. Employment is measure of sustainability over projects that recycle for revenue generation

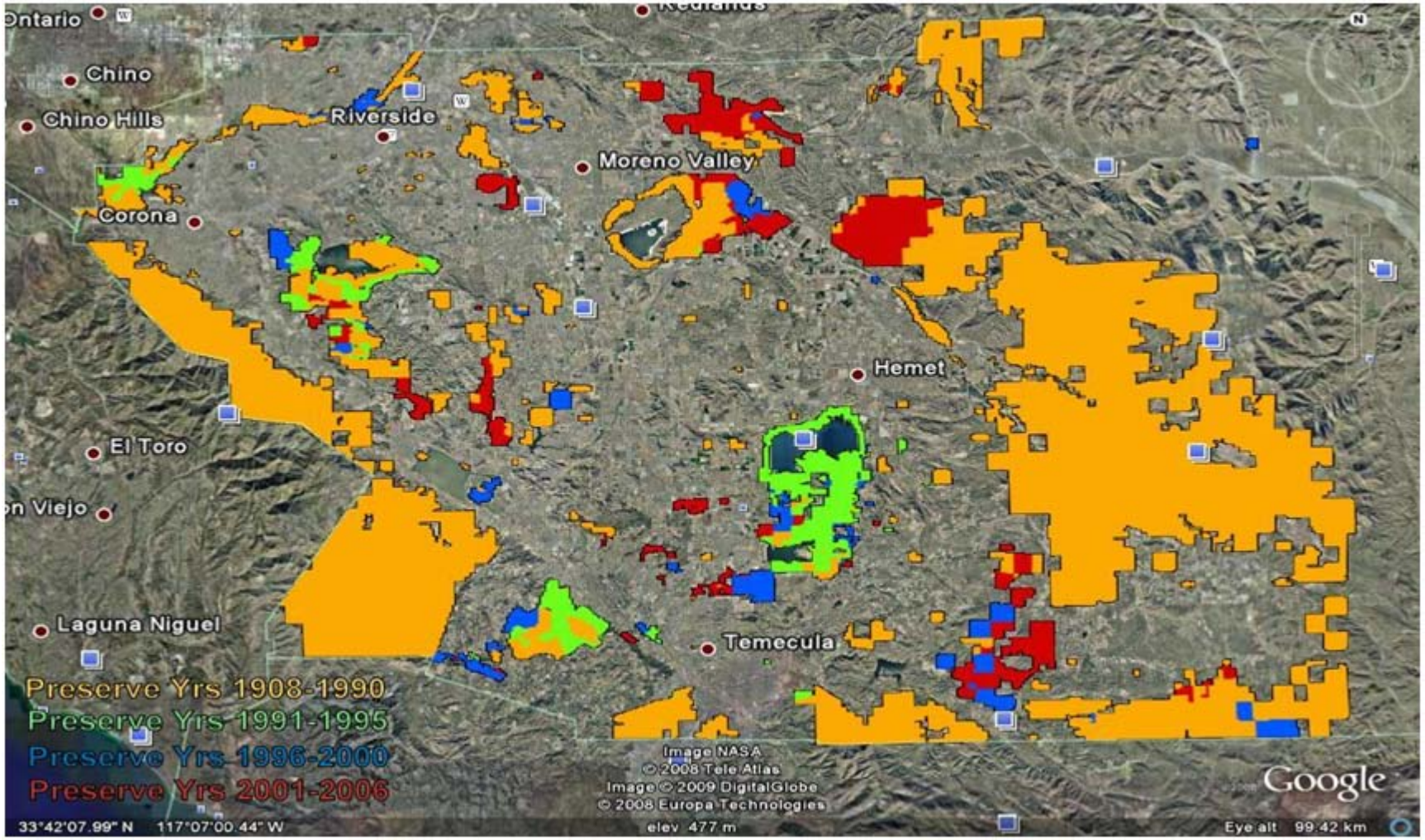
- An equitable split of finances and number of projects between the U.S. and Mexico is not a goal. As of February 2011, 82 projects in U.S. and 95 in Mexico
  (86% are water and wastewater and 14% are solid waste)

- While the upstream country always has a project approved, that country does not bear all the cost, with NADBank and EPA grant funding.
- Next: check growth inducing effect of funding-how do user fees measure up to initial funding?

Dynamic Analysis Of Open Space Value With a Preservation Policy.
With W. Bowman Cutter,Thomas Scott.

- Introduction: Open Space and Watershed Policy and Valuation
- Research Design: Improvement over other attempts to distill value
- Panel Data: Unique data with changing amenity in time and space and repeat sales
- Estimation Results: Value changes over time and space and policy
- Conclusion: Dynamic policy matters

Endangered Species Act Driven Open Space Acquisition.



Background

- Open space abundance and distance to residences may be changing over time due to acquisitions made by public rmanagers (in Riverside County). (Due to ESA for habitat and for watershed and water quality)

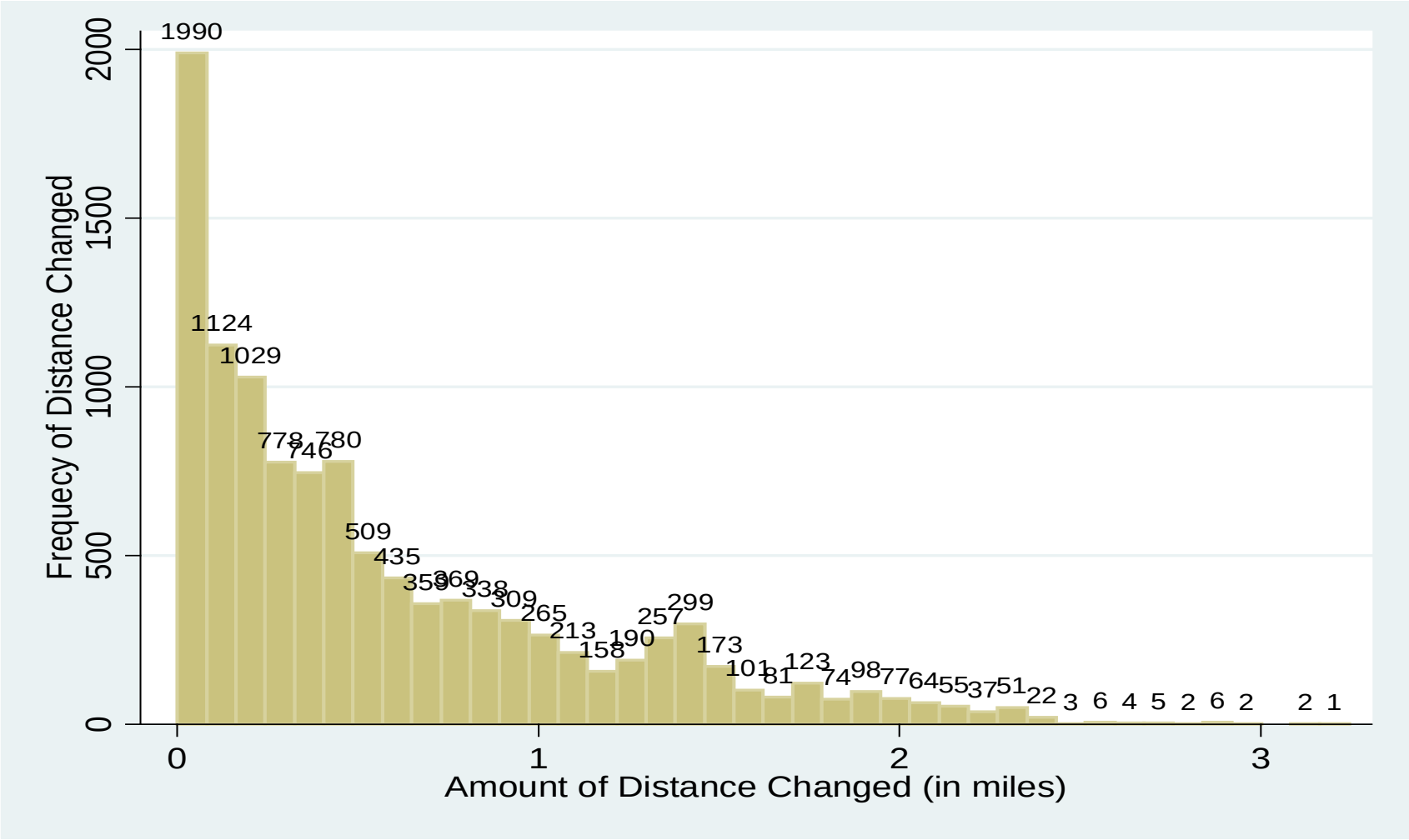
- The market value of a residence is the price buyers are willing to pay for the residence with a bundle of attributes.

- The buyer's marginal utility derived from open space is a function of the distance the residence is from the preserved open space where theory predicts that people place higher values on goods with more desirable attributes, such as proximity to open space.

- Residences have sold more than once and both the dynamics of sales and changes in open space can be simultaneously explored here.

- We measure the difference in value of open space that is permanently protected through a formal Riverside County policy versus temporary open space.

Frequency of Distance Changed over Multiple Sales



Experiment to Distill Differences in Value Statistically.

1. Propensity Score Matching:

- Divide data into two groups: one with distance change to open space (treatment) and one without distance change (control)

Issue:

- Matching control and treatment observations removes bias.

2. Parametric Model

- Repeat sales framework.

Conclusions

1. There are significant benefits to residential property values for designating open space in permanent preserves.
2. Decreasing the distance increases the value on average of the residence by $2918 or 1% of 2004 estimated sale price. The total increase amounts to over $30 million.

3. We do not find support for a lagged capitalization effect as the RCIP policy generates abundant open space during and after it is announced.

4. We contribute a new analysis with unique data allowing for dynamic and spatial distinction of the marginal value of open space to residential property.

5. Our econometric analysis offers rigor in controlling for all other influence on changes in residential property value.

Policy Implications and Next Steps

- With dynamic change in the marginal value, policies such as development impact fees should take such change into account (Kangaroo Rat fee in Riverside County)

- Such fees can apply to tourism-based commercial development (hotels) featuring access to nature.

- The timing and rate of open space acquisition matters for both meeting habitat and watershed goals as well as private real estate values

- We are now analyzing with on site changes such as renovations.

Various scales of analysis for more than one decisionmaker to control invasive species (biological pollution)

- (1) between trading countries (commercial shipping);
- (2) across boating industry and recreational boaters in two countries
- (3) Aquaculture and aquarium activity in shared wetlands
- Investigate incentives and policies to prevent invasive species from hitchhiking on boats through pollution prevention technology and management practices

Find Cost-Effective Solutions

5 months fouling on gel-coat – August 2008 – San Diego Bay

ECONOMIC STUDY:

✔Cost/availability of supplies and services to control AIS & other fouling species on boats traveling California & Baja California coasts, bays, and Sacramento-San Joaquin Delta

Find cost-effective ways to:

✓Prevent hull transport of AIS

✓Reduce use of toxic antifoulants as per CA TMDLs

✓Avoid ban and policing

✓Avoid ineffective eradication

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Marine Supply Store, La Paz, Baja Cal Sur

Binational Sample includes California and Baja California

- 98 CA & 8 Baja CA Marinas, Harbors, Yacht Clubs
- 28 CA & 5 Baja CA Boat Repair Yards
- 23 CA & 4 Baja CA In-Water Hull Cleaning Companies

California & other W.States:

- 3 Slip Liner Companies

Other U.S. States:

- 17 Boat Lift Companies

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Cost and Awareness

- Awareness of nontoxic coatings <u>is</u> statistically significant in influencing coating choice
- Cooperative Extension Ed. Material leads to 50% increase in awareness
- Cost is <u>not</u> statistically significant

Varied boat traffic leads to different water quality control options

- Since 49% of boats never leave their own harbor, performance bonds and "evergreen leases" for slip space are viable policies for implementing nontoxic coatings to avoid exceeding TMDL on copper in harbors
- For boats leaving harbors, avoiding additional fuel and speed loss costs from hull fouling offers incentive to regularly remove biofouling. The lifetime of nontoxic coatings (twice as long as heavy metal coatings) is another incentive.
- Increasing availability of nontoxic coatings is needed binationally.
- Incentives (subsidy + liability) or (tax + liability) help combat invasive species through promoting hull coating prevention when there are uncertain damages and asymmetric information

- Subsidies and taxes achieve same level of pollution control and welfare. The difference is private profits are lower with taxes.

Opportunities for Complementary Work at WRRC

- Expand transboundary water quality and quantity management research accounting for hydrological variability due to climate change in policy and institutional planning

- Evaluate diversified energy portfolio policy incentives (turning liability into asset-invasive golden algae into biodiesel in Arizona)

- Cross Media Environmental Management between air, water, land resources for physical infrastructure in energy generation and transmission

- Az Water Meter and water reclamation (public and private centralized and decentralized incentives)