# Experimentation in Federal Systems

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June 2012

# Motivation

- *"It is one of the happy incidents of the federal system that a single courageous state may, if its citizens choose, serve as a laboratory; and try novel social and economic experiments without risk to the rest of the country."*
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  - experiments are useful to all states – preferences are similar
- E.g., California with environmental standards, Alabama with school vouchers.

Questions: Will states choose the right quantity of experiments?
Will they choose the right type of experiments?

# Our Contribution – Part I

Develop a model with two key features:

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Bad News: Policy experiments are less socially beneficial.

Really Bad News: Threat of free-riding induces *Pareto dominated* policy choices.

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- Dynamic power sharing: Begin decentralized and become centralized.
  - centralization implies policy harmonization.
  - states compete for their policy to be implemented nationally.
  - Appropriate metaphor for federalism is a *tournament*, rather than a *laboratory*.

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3. *Economic theory: Experimentation and bandit-problems*
   - Heavy on free-riding, not on preference heterogeneity.
   - Bolton and Harris '99, Keller, Rady & Cripps '05, Keller and Rady '10, Rosenberg, Solan and Vieille '07

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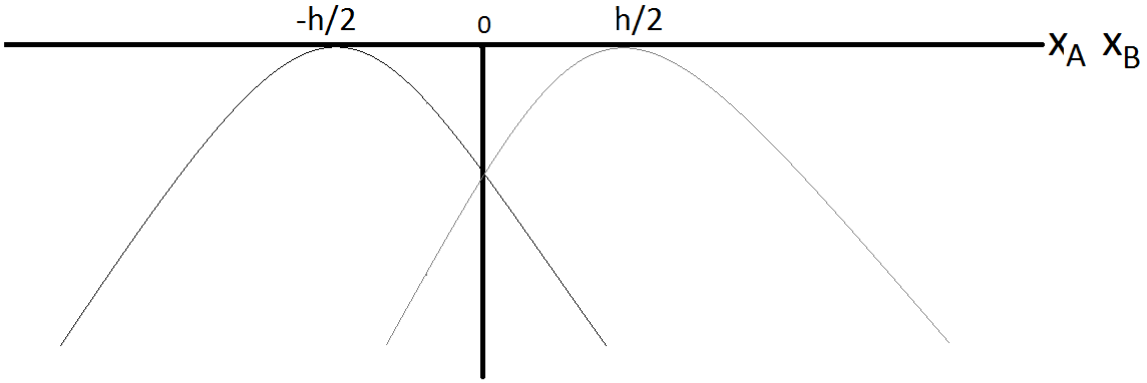
- Experiment is binary: succeeds with probability $p$, at cost $k$.
- Two districts (/states) with ideal points $t_i \in \mathbb{R}$, $i \in \{A, B\}$
  - Heterogeneity $h = t_B - t_A$.

# Timing – Decentralized System

1. Choose policy to explore: $x_i \in \mathbb{R}$, $i \in \{A, B\}$.
2. Play safe or experiment $e_i \in \{0, 1\}$.
   - outcomes observed $s_{x_i} \in \{0, 1\}$
3. Final policy chosen: $y_i \in \{x_A, x_B\}$, $i \in \{A, B\}$.

   - payoffs: $u_i = s_{y_i} - c(t_i - y_i) - k \cdot e_i$.
   - $c(.)$ is concave, $c'(0) = 0$.

# The First-Best



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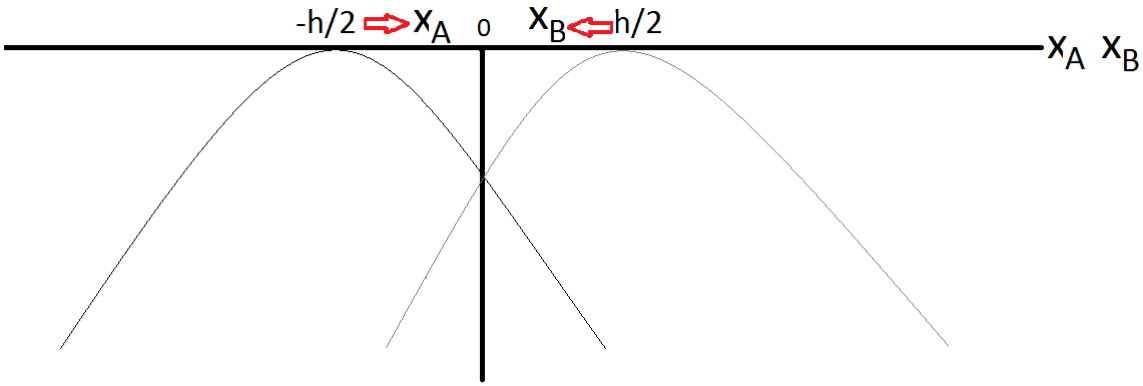

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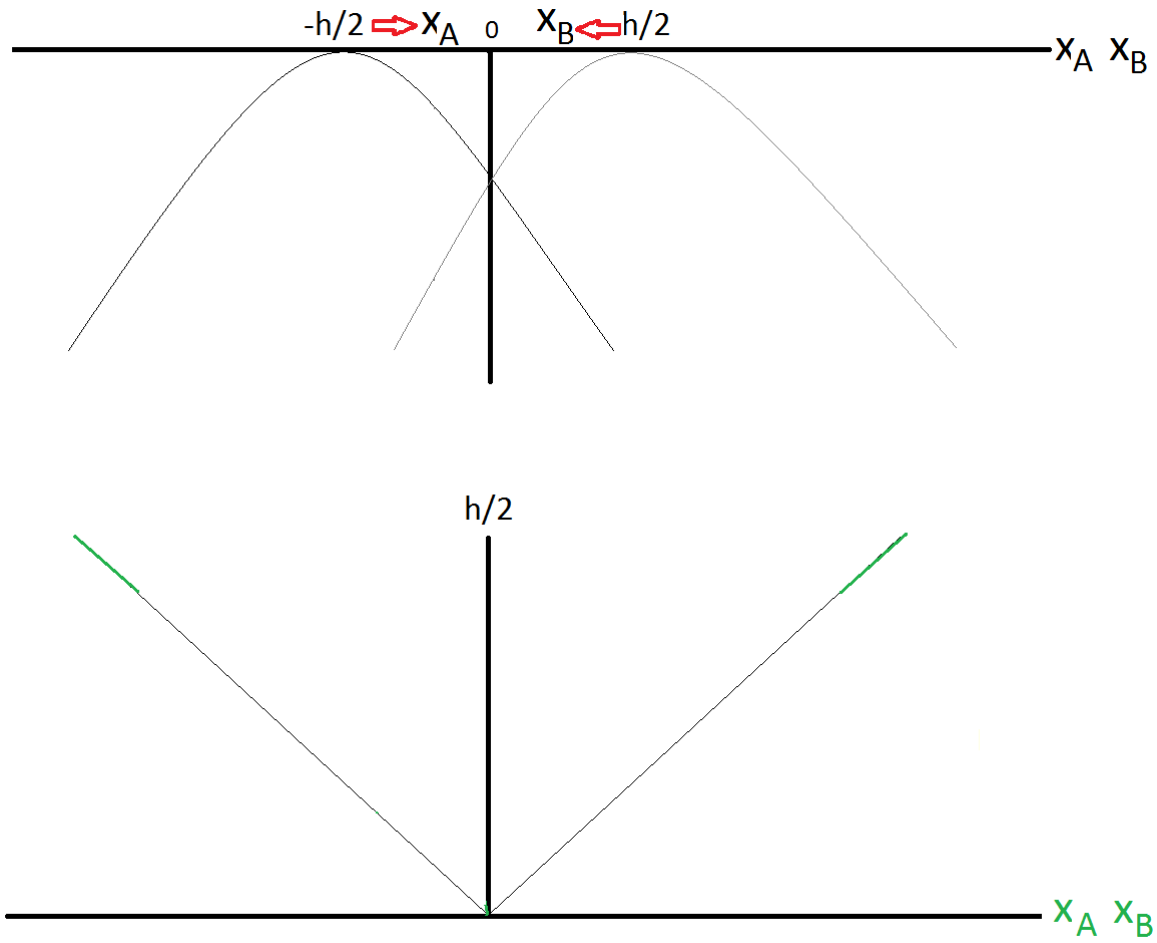

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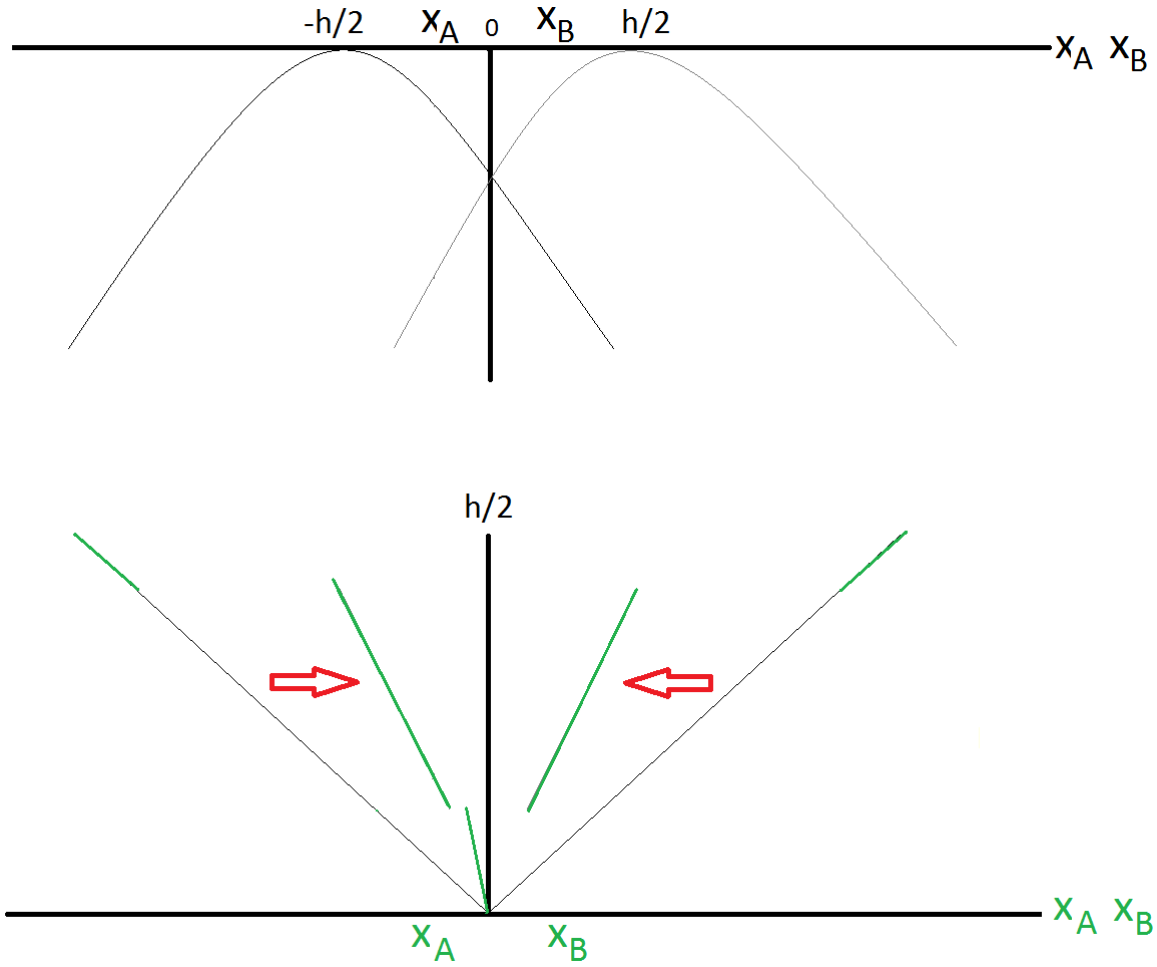

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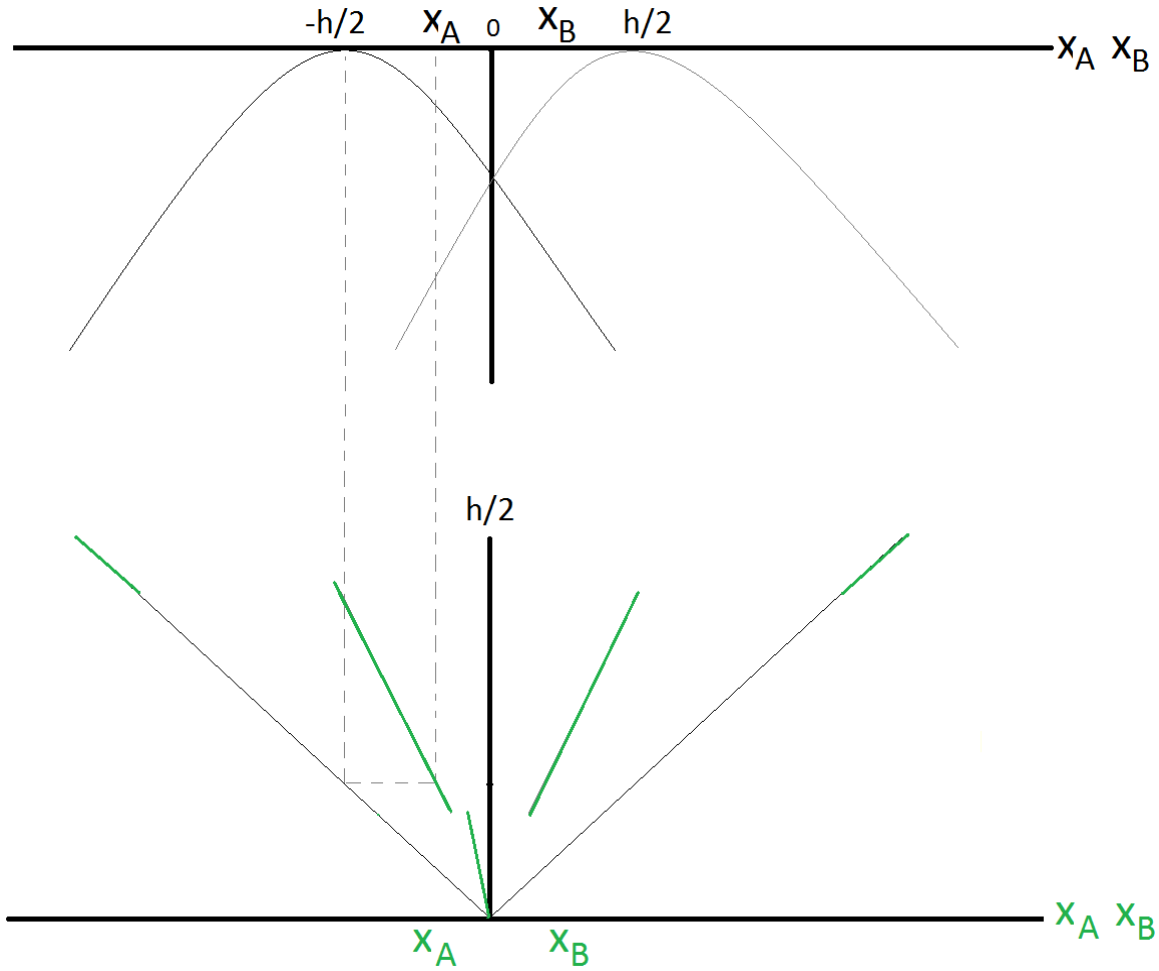

# The First-Best

## Proposition

- *Convergence from ideal points,* $t_A < x_A < 0 < x_B < t_B$*, is efficient iff* $h \in [h', h'']$.

- *Each district should accomodate,* $a_i = |x_i - t_i|$*, satisfying*

$$\frac{c'(a_i)}{c'(h - a_i) + c'(a_i)} = p(1-p), i \in \{A,B\}$$

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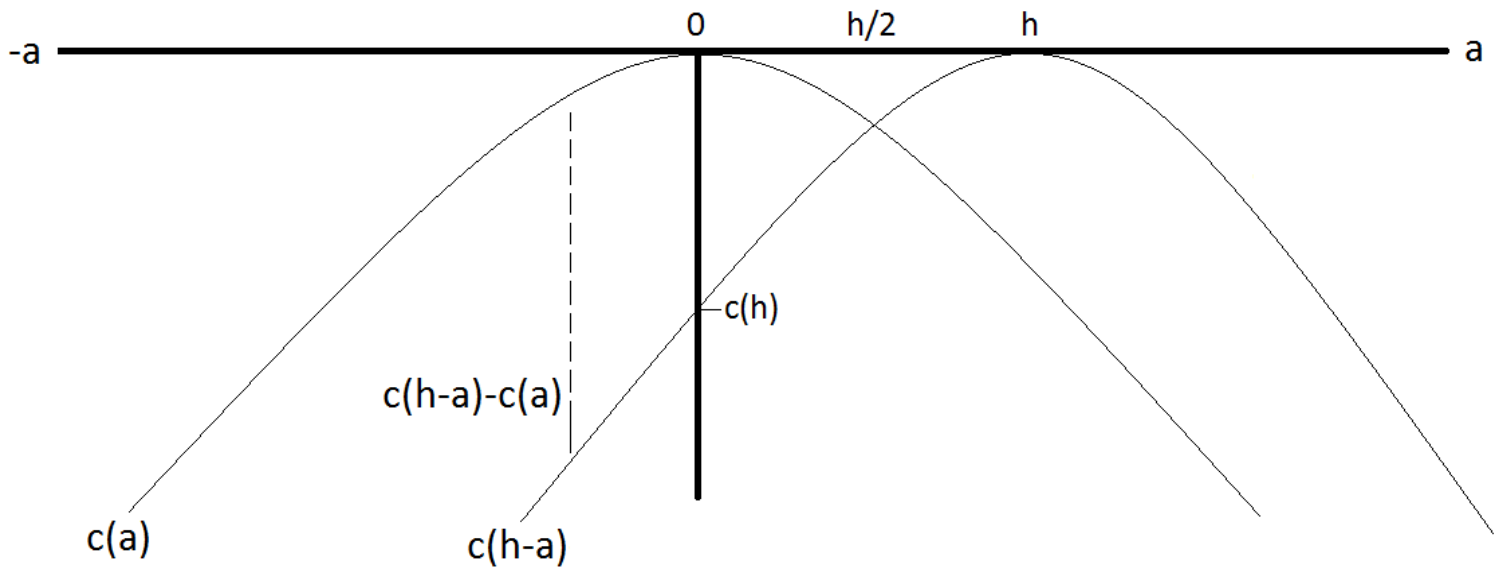
- If $k - p(1-p) > 0$, inducing both districts to experiment requires:
  - Heterogeneity $h > 0$
  - Sufficiently different policies $x_A \neq x_B \Leftrightarrow a < h/2$

# Decentralization - given (symmetric) locations

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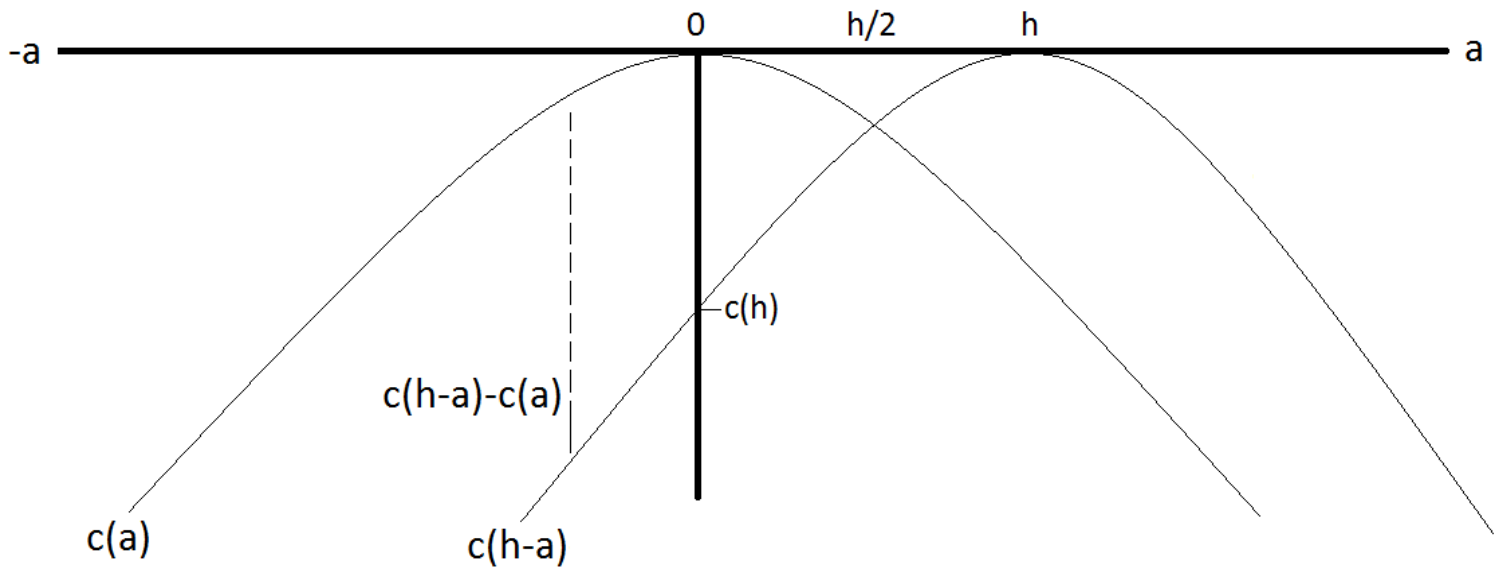


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- Possible *divergence.*

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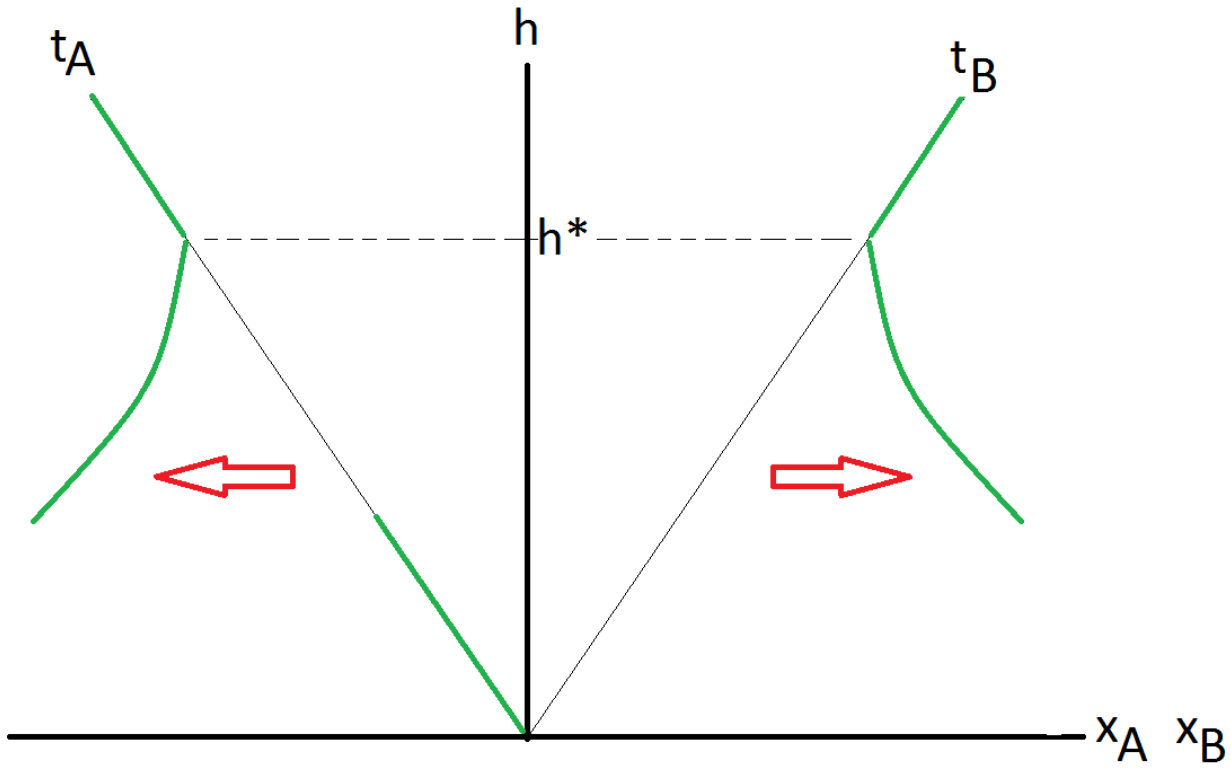


The local optimum $h^*$ is global if $k \leq 2p\frac{1-p}{2-p}$

# Decentralization - equilibrium locations

## Proposition

- *If* $h \in [h'_d, h^*_d)$, *experiments diverge:* $x_A < t_A < t_B < x_B \Leftrightarrow$ $a_i = a > 0$ :

$$c(h-a) - c(a) = \frac{k - p(1-p)}{p^2}$$

- *Divergence increases in* $k$ *but decreases in* $p$
- *The smaller is* $h$, *the larger is divergence:*

$$\frac{\partial |x_B - x_A|}{\partial h} < 0.$$

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- Otherwise, the game is as before

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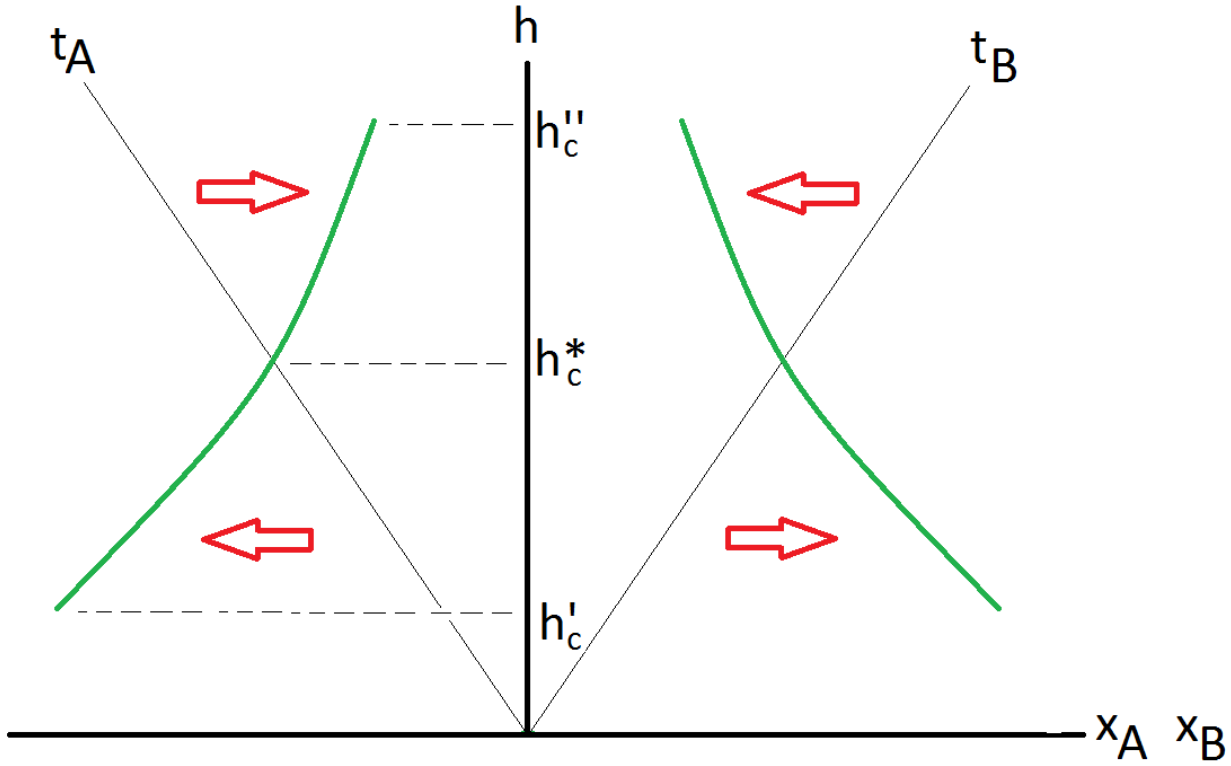
- *When choosing locations, inequality will bind*
- *Convergence is possible: accomodate median voter $\Rightarrow a > 0$*

# Centralization - Equilibrium Locations




The optimal heterogeneity is $h_c^* > 0$

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- *If* $p < 1/2$ *is small, centralization can be* **better**
- *If* $c(a) = qa^2$, *centralization is better for small* $h$, $q$, $p$ *and large* $k$:

$$qh^2 < [k - p(1-p)] \frac{1/4p^2 - 1}{1/2 - p(1-p)}$$

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- **Coffee-brewing**

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- Welfare policy in U.S.: Authority devolved to the states.
- Prescriptive theory: Constitutions should do it!