Conditional Markets

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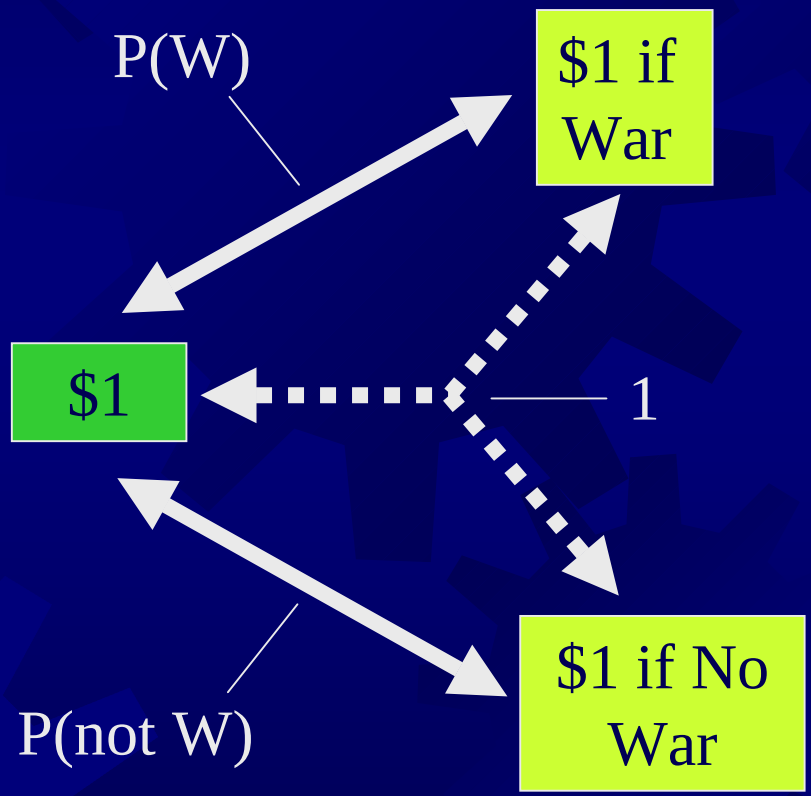
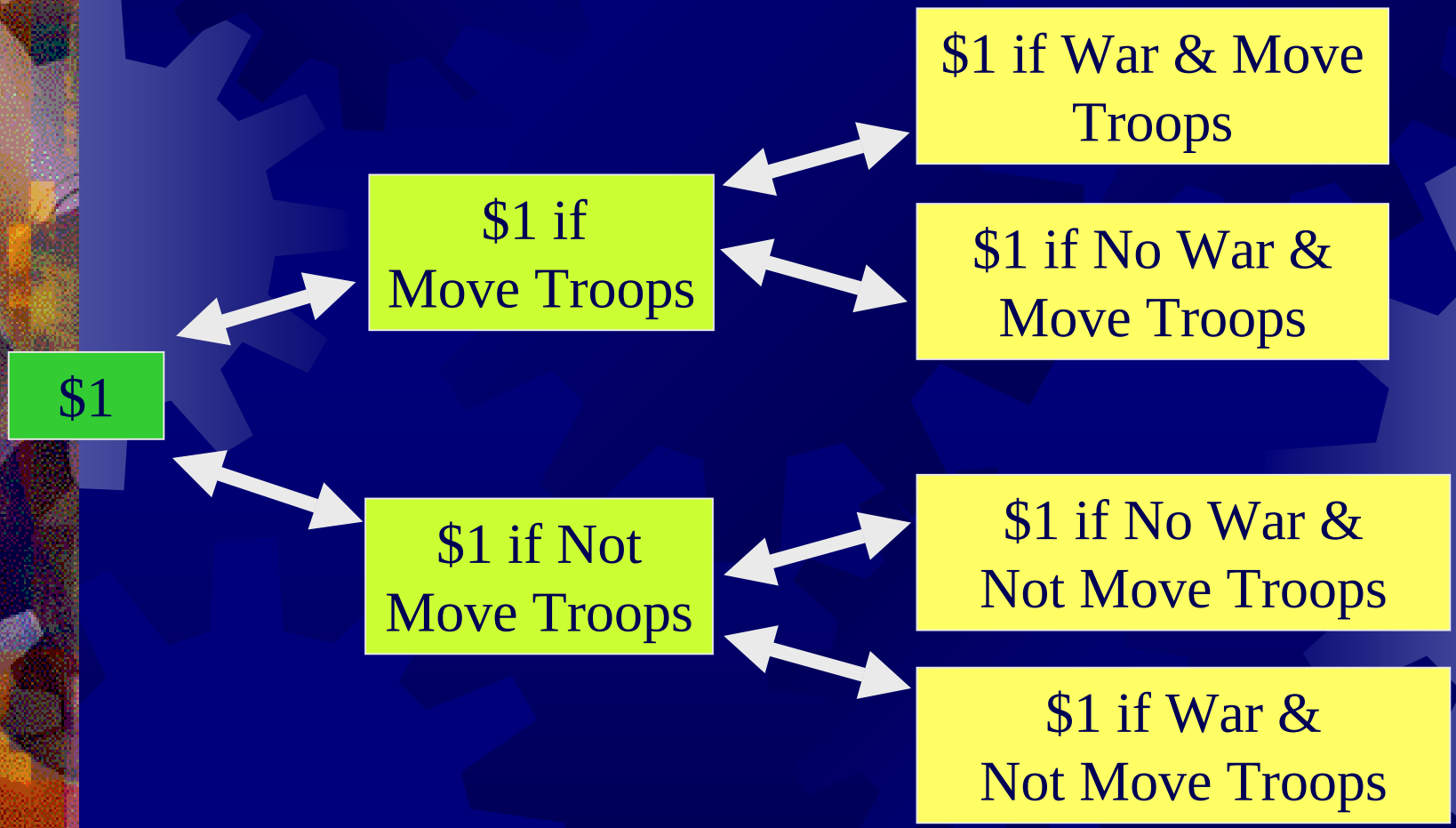
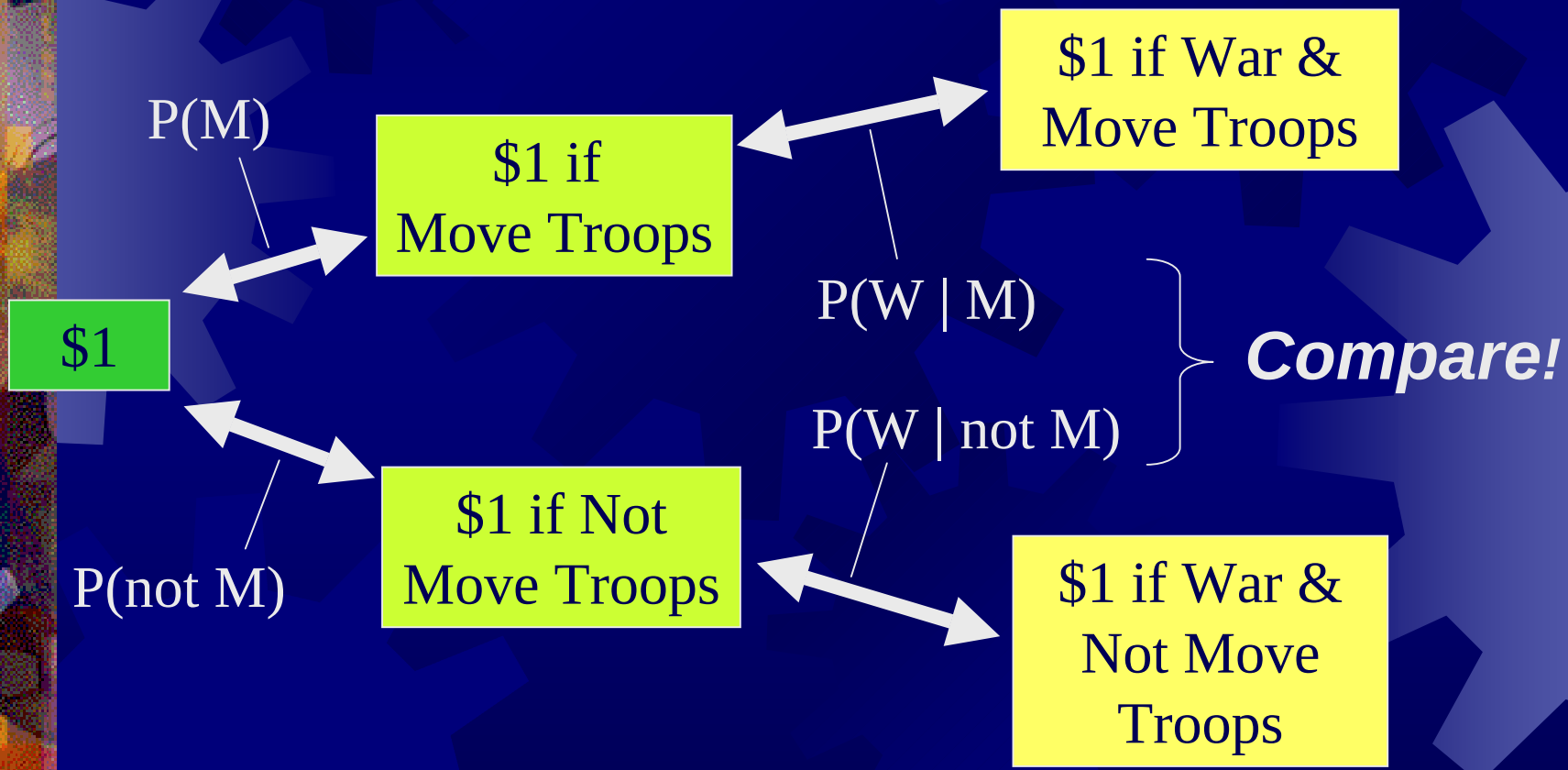
Predicting a War



Predicting War & Troop Move



Troop Move Decision Advice



Markets Can Estimate E(O|D)

Decisions	Outcomes
Move US troops	War deaths
Dump CEO	Stock price
Who US president	GDP per capita
FED raise rates	Unemployment

Potential Problems

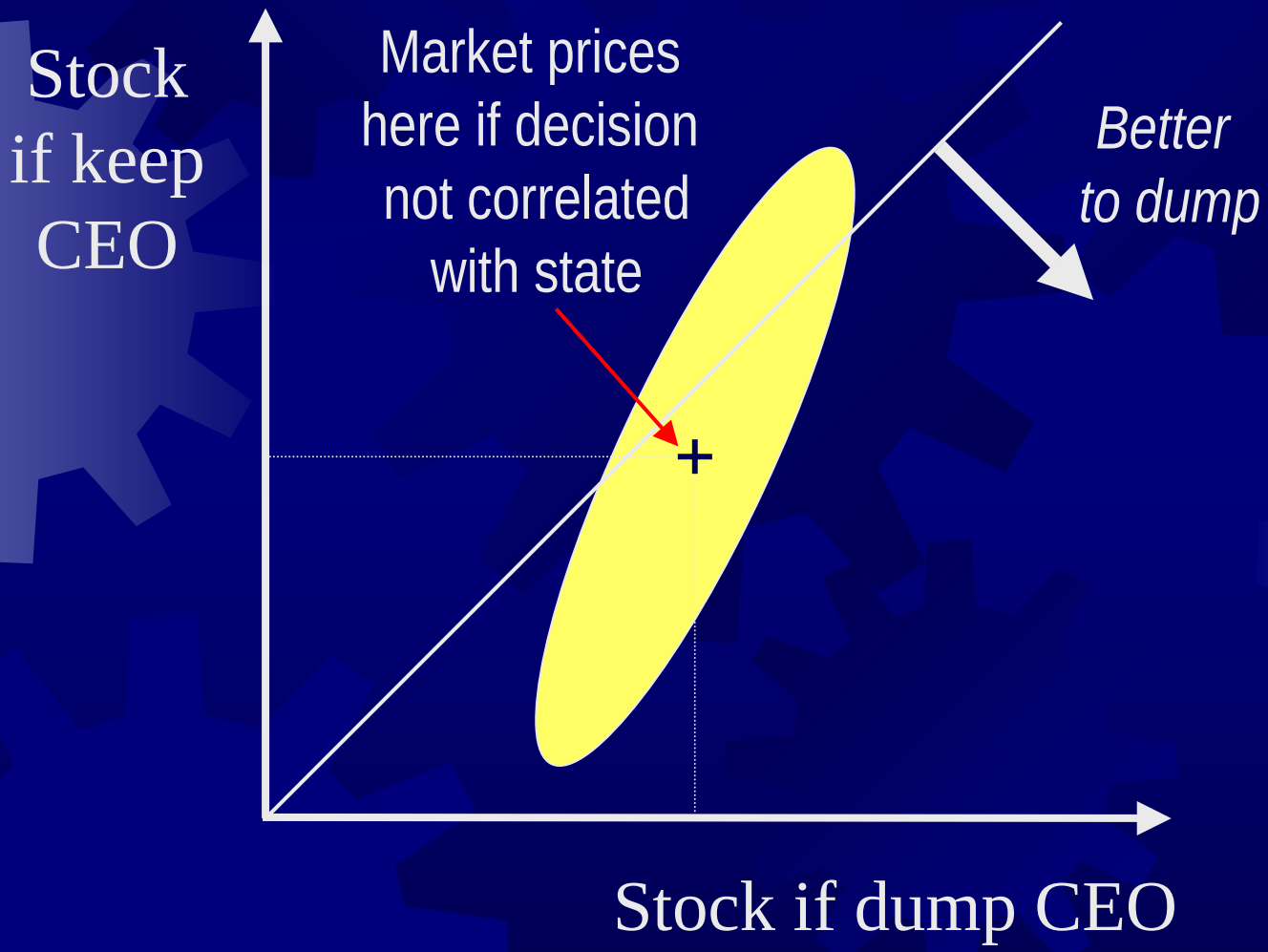
- Discuss in this talk
  - Decision selection bias
  - Incentives to bias
  - Thin markets
- Some other talk
  - Moral hazard
  - Regulation
  - Secrecy
  - Bozos
  - Reduce info sharing
  - Rich more “votes”
  - Risk distortion
  - Bubbles

Decision Selection Bias

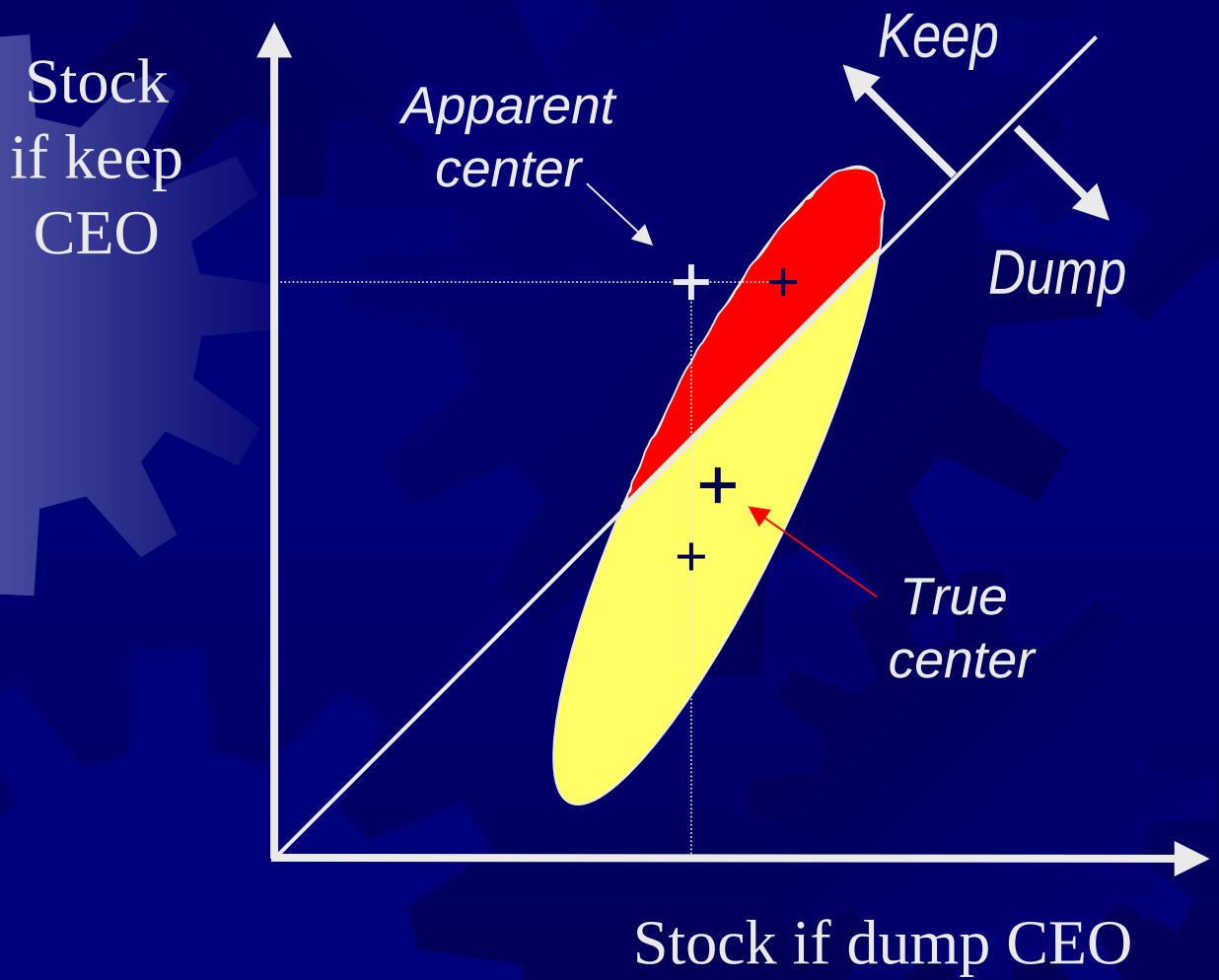
- If traders think deciders will use info traders do not have, conditional market price advice may contradict trader info
- Related to “Newcomb’s Problem” in decision theory

A Decision State Space

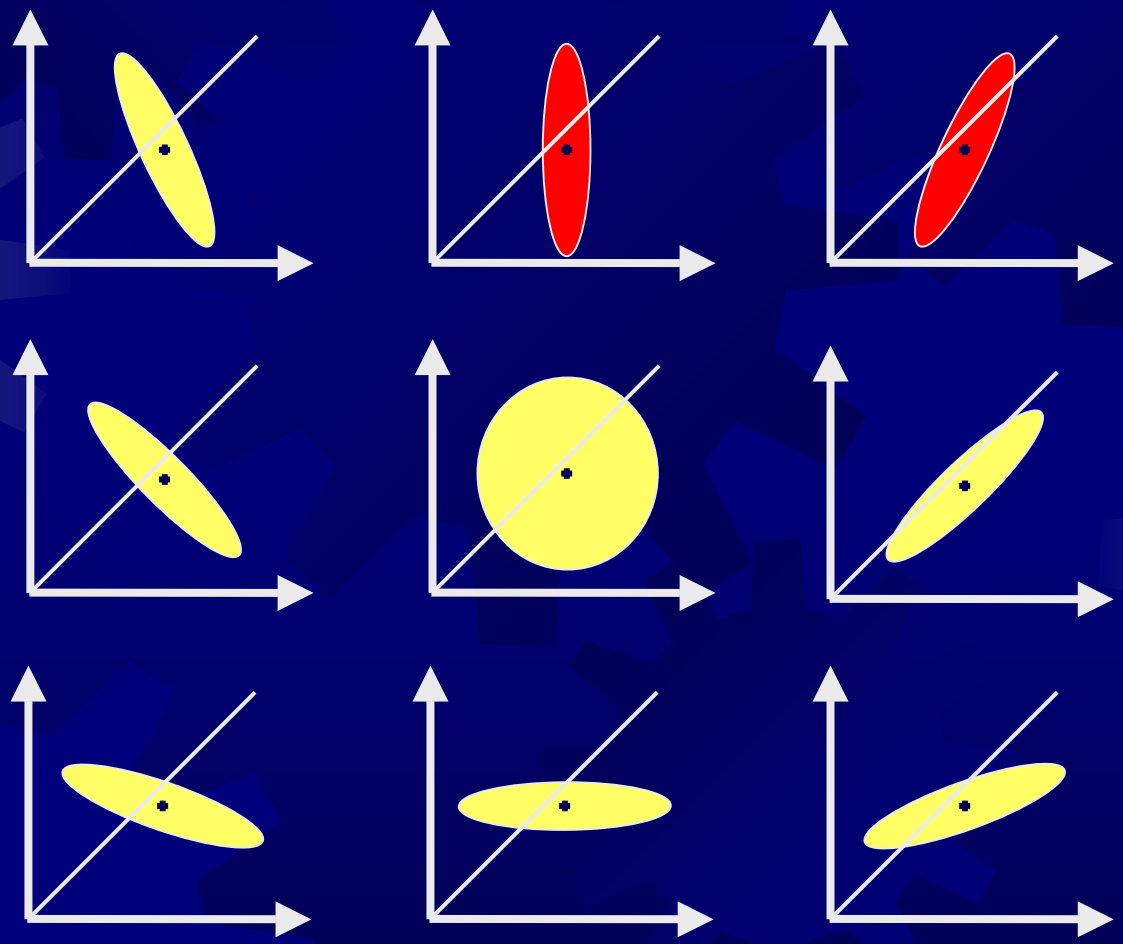
If No Selection Bias



Well-Informed Deciders



Problem Seems Uncommon



Avoiding Selection Bias

- Problem scenarios seem rare, but ...
- Let decision makers, advisors, trade
- Make decision time clear to traders
  - Use prices just before decision time

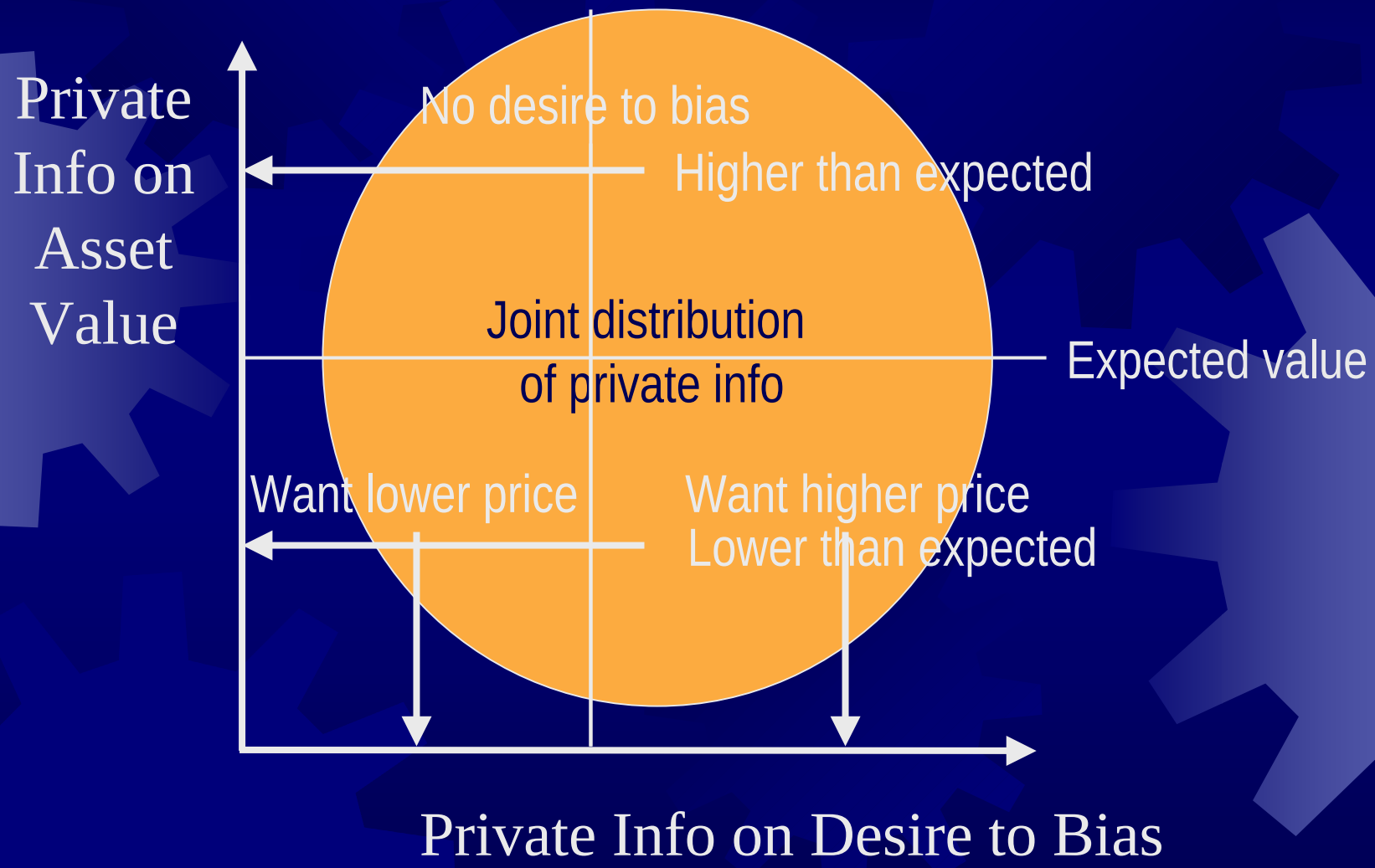
Desires to Bias

- Can interested parties “buy” a favorable decision via trades?
  - Decision gains might outweigh trade losses

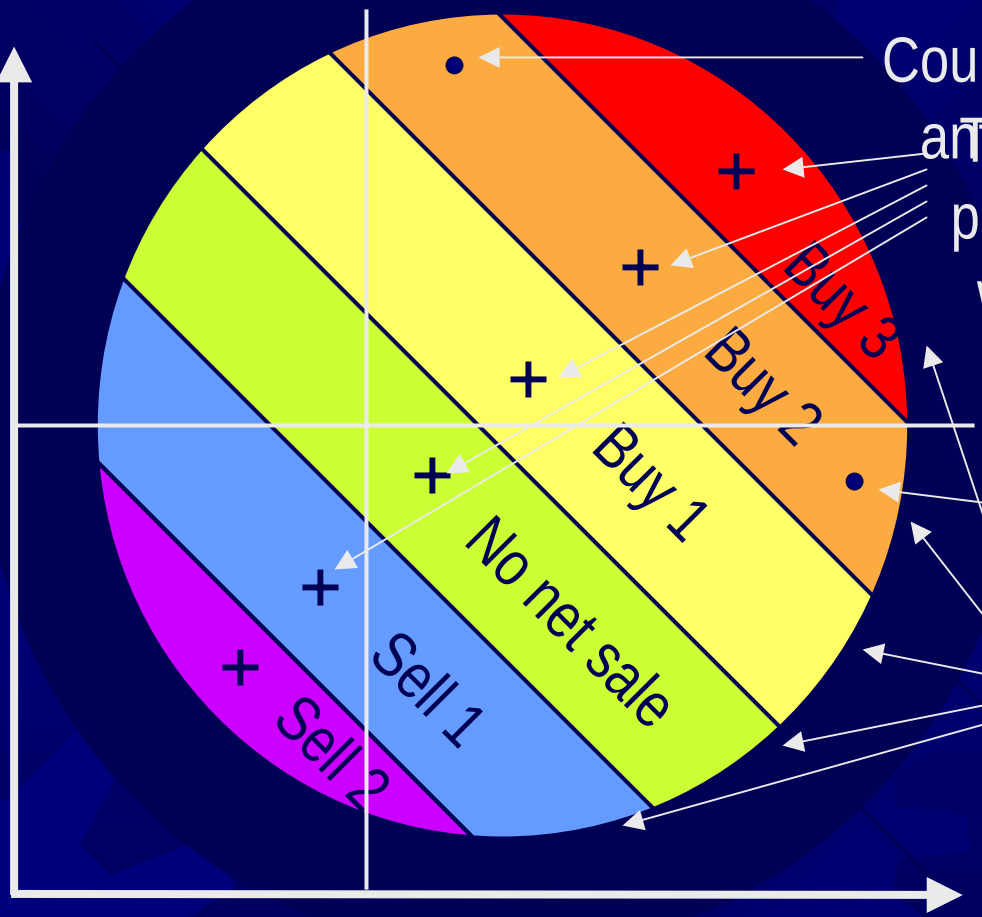
Market Microstructure Models

- Traders Types
  - Uninformed
  - Informed
  - Noise
  - Liquidity
  - *Bias*
- With private Info on
  - Nothing
  - Asset value
  - Next random act
  - New risk to hedge
  - *New desire to bias*
- Order of events
  - All but uninformed traders choose order amount
  - Uninformed see only total order (per group)
  - Uninformed set price to expected asset value

A Graphical Model of Bias



Simple Bias Equilibrium



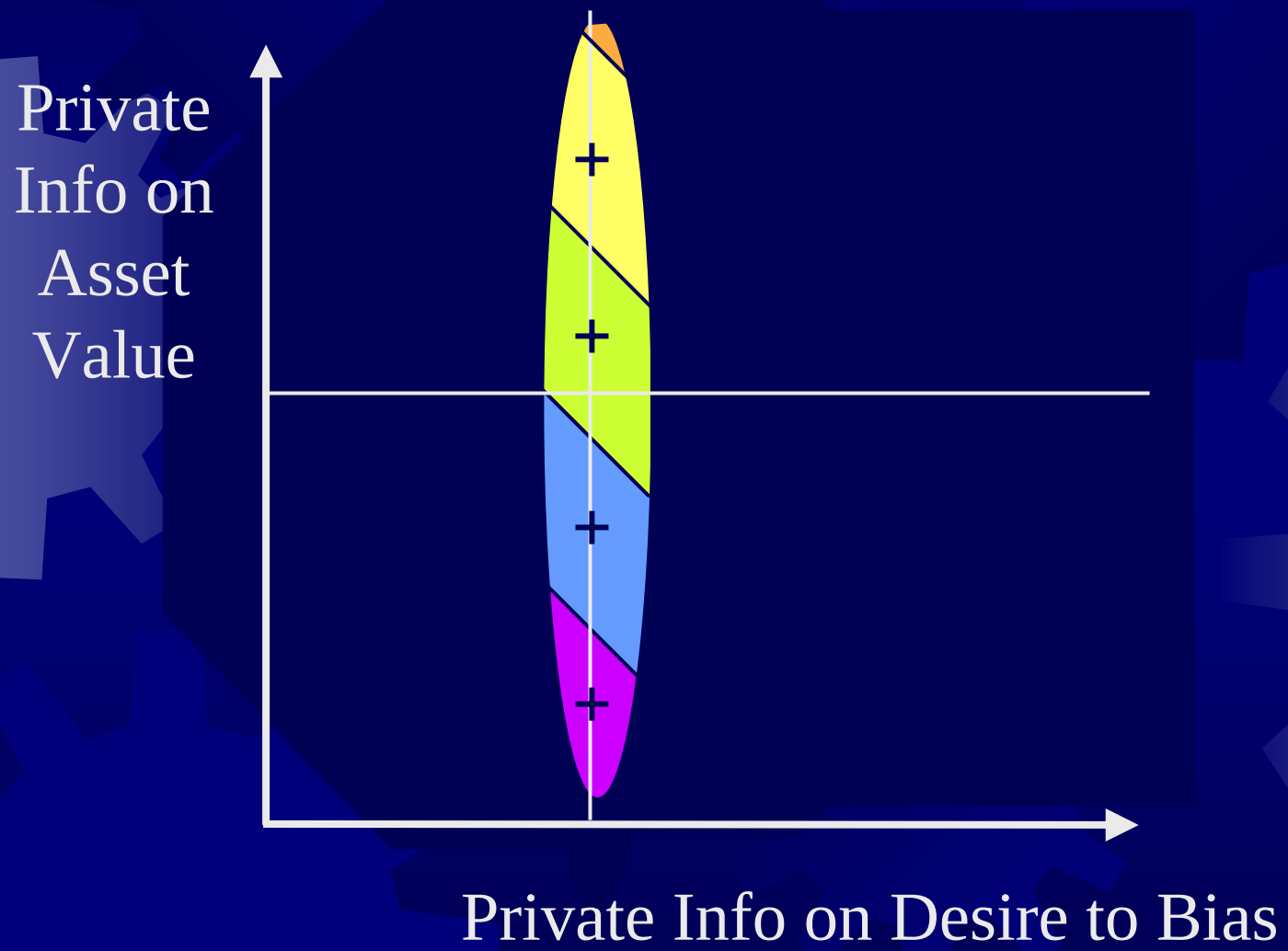
Counter-balanced by another bias

The bias implies price should vary with net orders

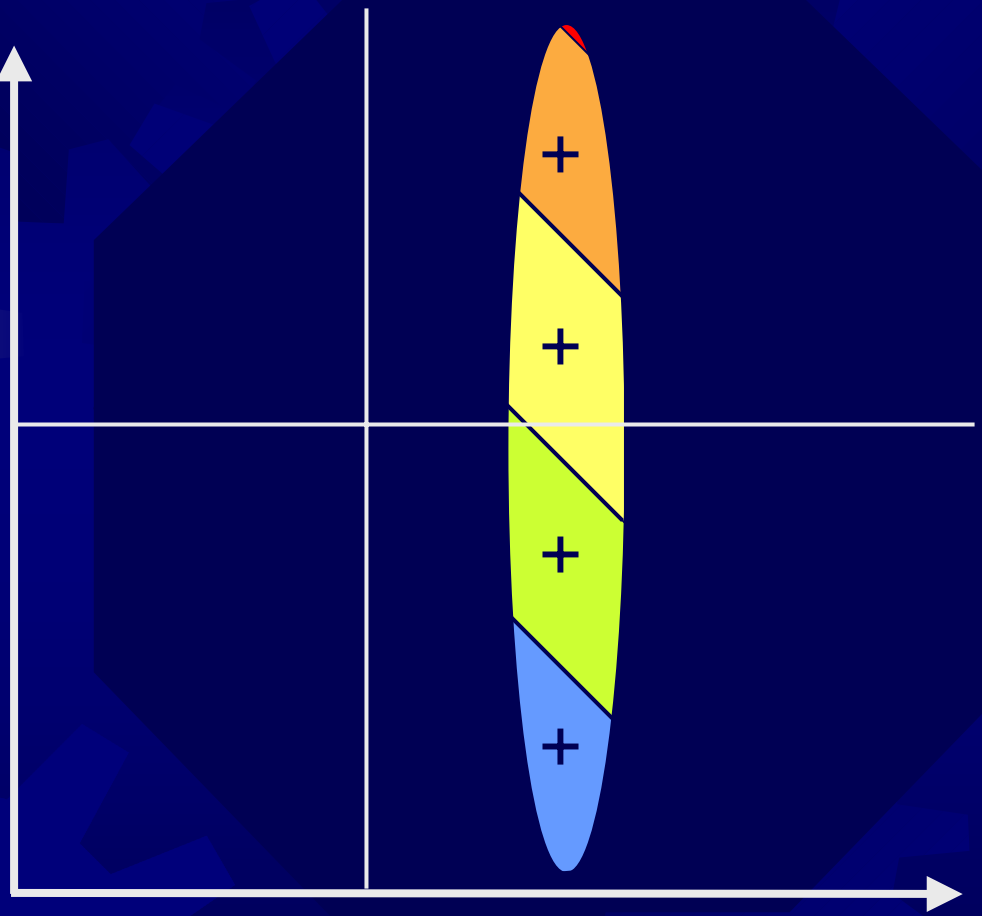
Assume monotone in asset info + bias desire × price effect

An example of successful bias

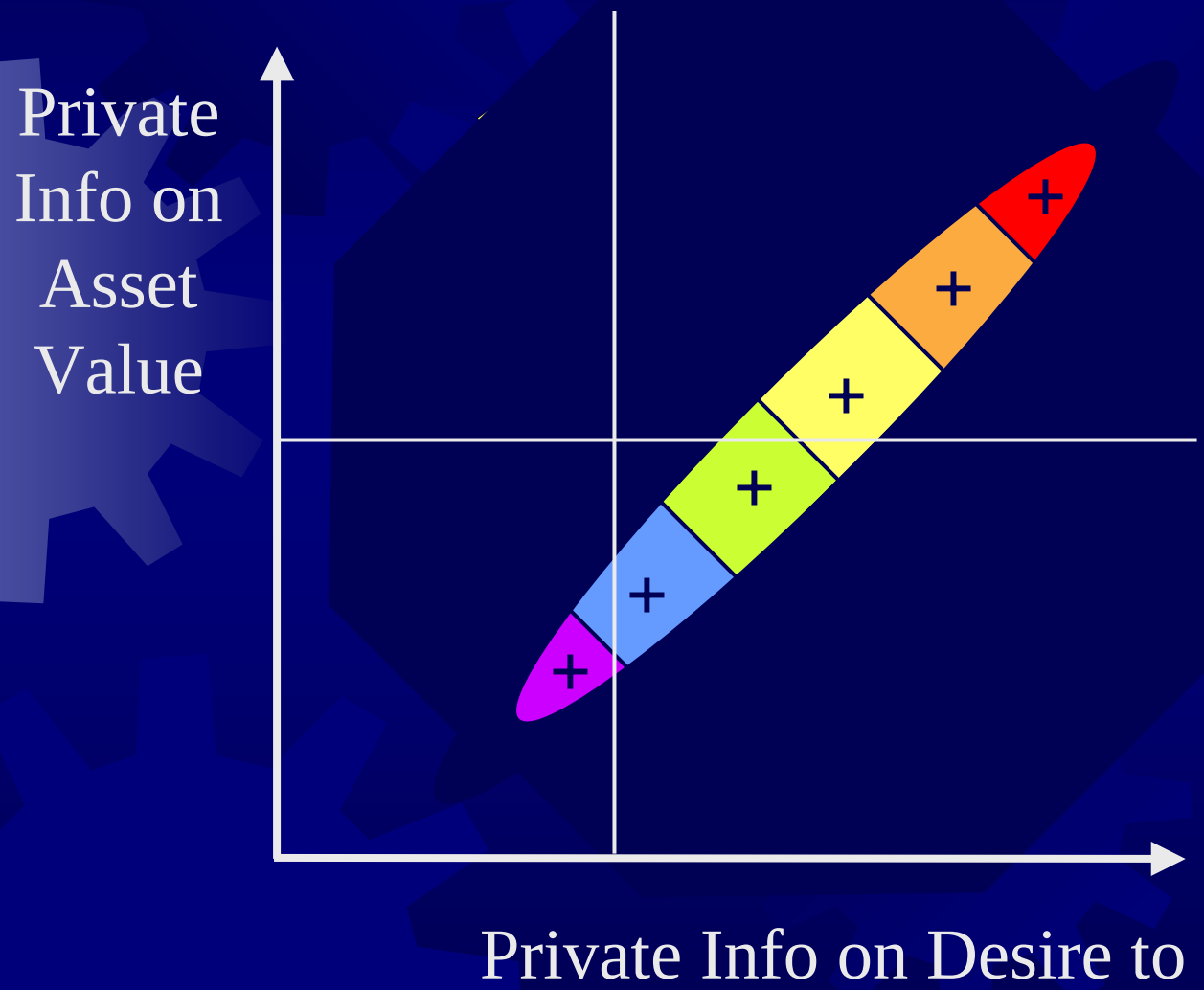
Baseline: No Bias Desire



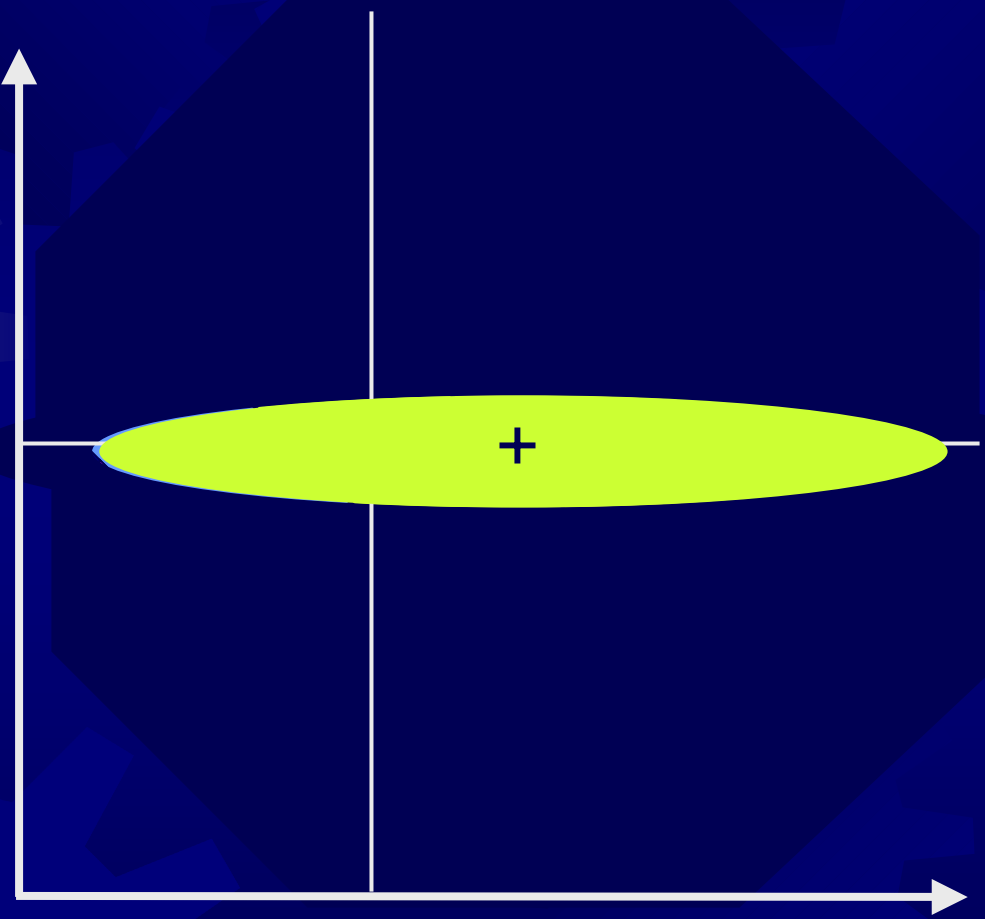
If Bias Known, Has No Effect



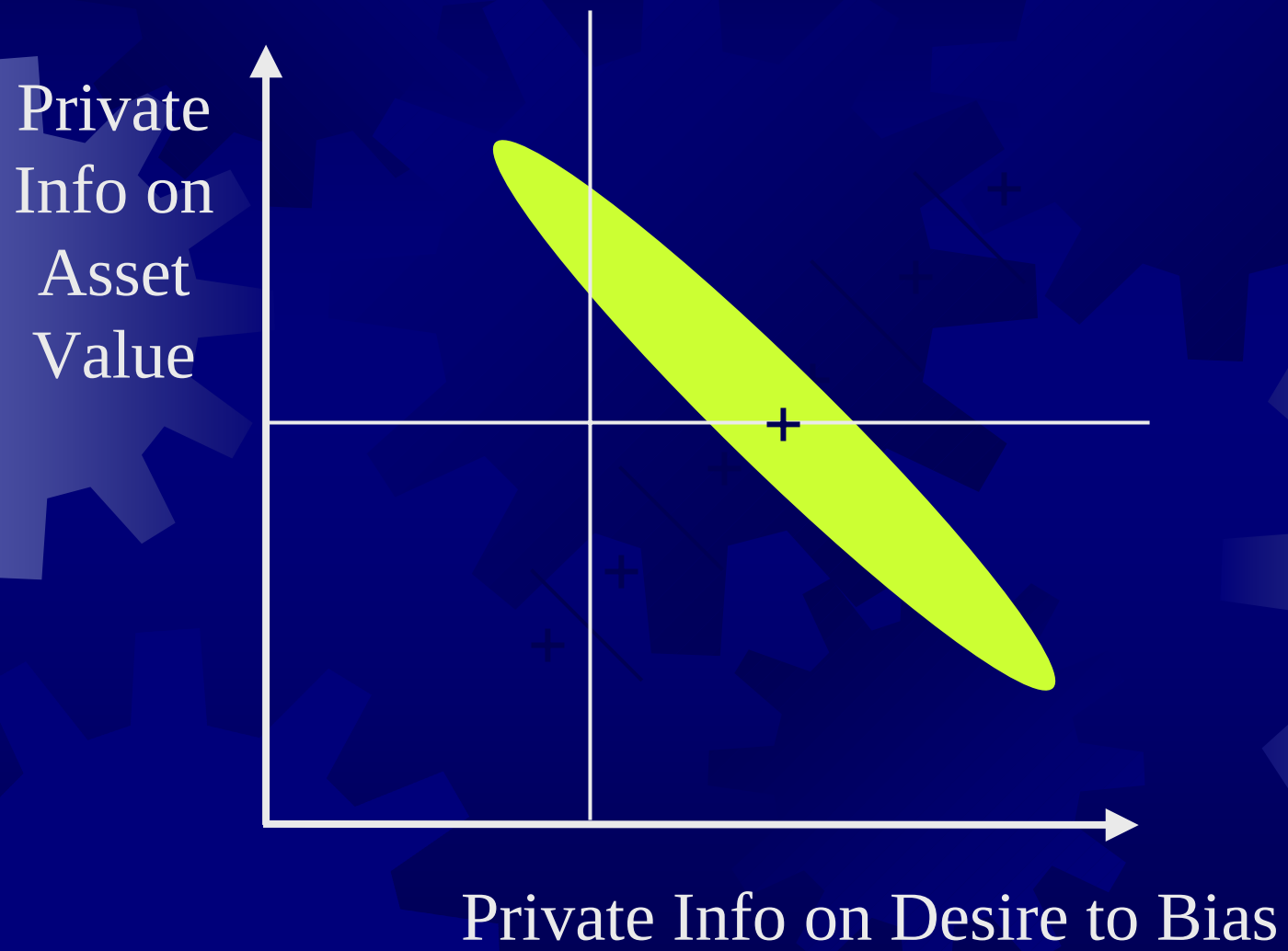
Strong Correlation, Low Effect



If No Value Info, No Effect



Neg. Correlation, Less Info



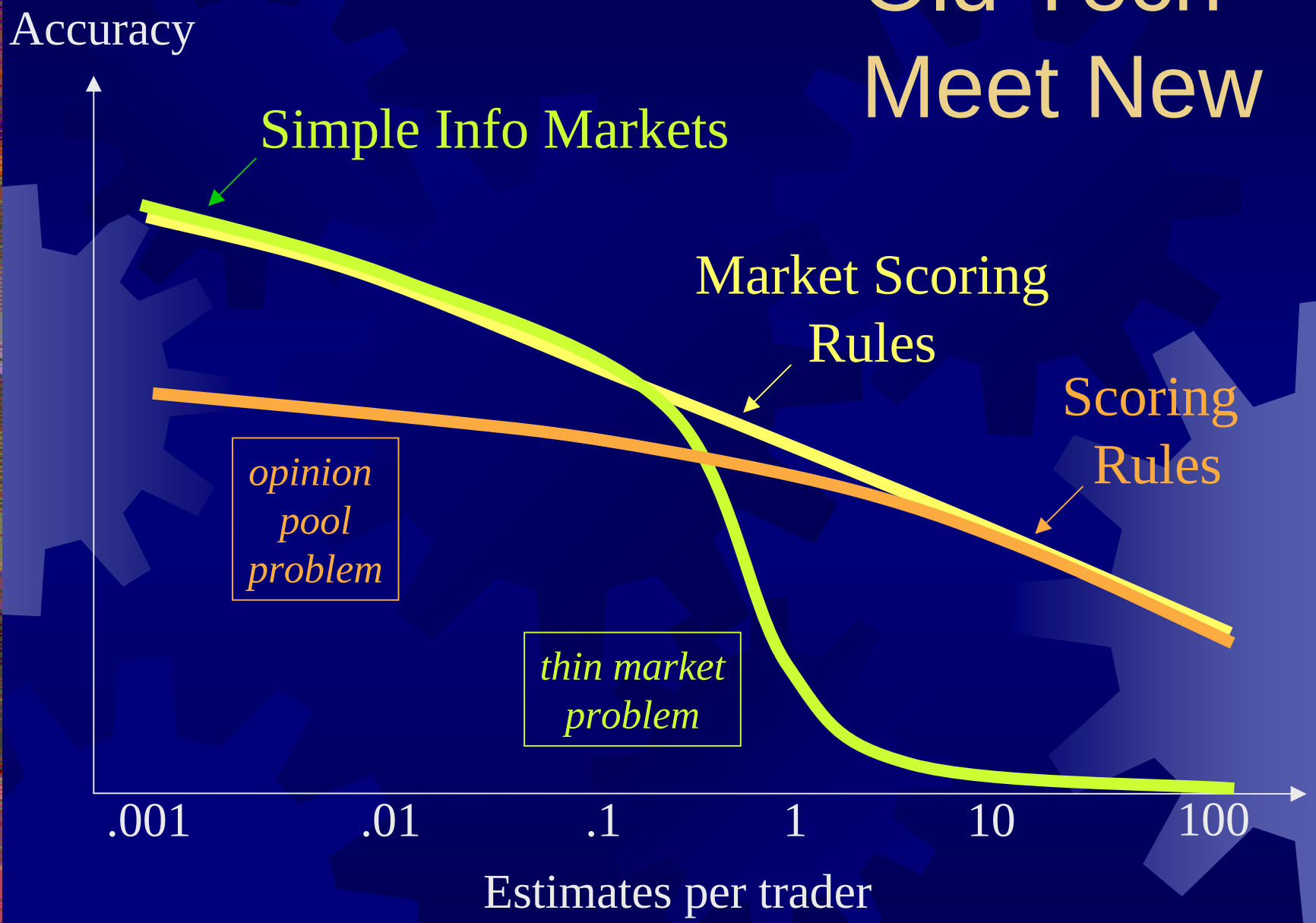
Bias Model Implications

- For any group can discern net trades
- Desire to bias has no effect if either
  - Known aggregate bias desire level, *or*
  - Known group has no info on asset value
- Mixed value/bias info hurts accuracy
  - But adds liquidity, attracts speculators!
- Better to ensure can discern group net trades, than to ban group from trading

Thin Market Problem

- For N events, ~N^2 possible conditionals
- To trade, must *coordinate* assets, time
  - Waiting offers suffer adverse selection
  - Call markets, combo match, help, but ...
- Few possible info markets exist
  - Most illegal, but for most of the rest, expect few traders, so don't bother to make offer
- *If known that only one person has info on topic, simple info market won't reveal*

Old Tech Meet New



Market Scoring Rules (MSRs)

- Proper scoring rule elicits your $\boldsymbol{p} = \{p_i\}_i$
  - if report $\boldsymbol{r}$, state is i, paid $s_i(\boldsymbol{r})$ [e.g.,= $log(r_i)$]
  - if risk-neutral, state-indep. utility, $\boldsymbol{r} = \boldsymbol{p}$
- MSRs let anyone change a shared $\boldsymbol{p}$

  "A scoring rule anyone can use at any time, if they agree to pay off the last user"
  - User t paid $s_i(\boldsymbol{p}^t) - s_i(\boldsymbol{p}^{t-1})$
  - If disagree with $\boldsymbol{p}$, expect to gain if correct
  - Gain if i where p_i ↑ , lose if i where p_i ↓

MSR is Auto Market Maker

- $p_i(\mathbf{s})$ gives 0-spread price on *any* asset

  \$ x = { \$ x_i if i }$_i$ for any variable x_i

- Net sales $\mathbf{s} = \{s_i\}_i$, if sell s_i of \$1 if i
- If x_i tiny, price of \$ x is $\Sigma_i\, x_i\, p_i(\mathbf{s})$
- If x_i big, integrate over changing $\mathbf{s}$
- Log MSR: $p_i(\mathbf{s}) = exp(\lambda s_i) / \Sigma_k\, exp(\lambda s_k)$
  - Cost/subsidy bounded, goes as number of variables, when $i = (v_1, v_2, v_3, \ldots)$

Summary

- Conditional info markets can advise decisions, but have potential problems
- Decision selection bias avoided by let insiders trade, make decision time clear
- Desire to bias can reduce accuracy of info source, but produces no net bias
- Liquidity for all possible state-dependent assets provided by market scoring rules