Strategic Adjustment
**Key Idea**

Actions “up the tree” affect actions “down the tree”

If fail to account for strategic response to policy change, implement ineffective or incorrect policy

Have to anticipate adaptation when designing policy

This also makes it important to measure the right outcome
OUTLINE

PEOPLE ADAPT

EFFICACY AND ADAPTATION
  College Affordability
  High Stakes Testing
  Welfare to Work

COUNTERTERRORISM
Car Notches 1

Sometimes by a large margin. Overall, there are 150 models at whose rating ends in .5 and 99 whose rating ends in .4. The probability that, of 249 draws, 150 or more would be drawn from a binomial distribution with equal probability is just 0.0007. If we widen our window and compare the number of models at .3 and .4 to the number at .5 and .6, the story does not change: 200 are just below the notch, and 295 are just above.

The counterexamples to the preponderance of .5 decimals over .4 decimals are high-performance, high-price ultra-luxury automobiles with very low fuel efficiency. Manufacturers of these cars may perceive that their prospective buyers care little about a few hundred dollars because it is a small fraction of the total cost, or even perceive that a low mpg is a status symbol of high performance. These models also have relatively low sales volume, so that if modification involves a fixed cost, we would see less bunching among these vehicles. To capture this possibility, Fig. 3 replicates Fig. 2 but weights the distribution by sales volume. Note that the total economic impact of manipulation depends on the sales-weighted distributions. In this figure, the predominance of .5 decimals is even more pronounced, and the integers where .5 does not predominate feature very low sales.

Fig. 4 aggregates across integers to show a histogram of mpg decimal values for all vehicles subject to the Gas Guzzler Tax. For example, if a vehicle had a 20.5 fuel economy rating, we put that vehicle into the .5 category.
Car Notches 2

Subject to Tax

Not Subject to Tax
Baby Notches U.S.

Tax benefits to having child in December instead of January in U.S.

Many more children born in final week of December than first week of January

A $500 increase in tax benefit of having a child increases the probability a child is born in the last week of December rather than the first week of January by over 25%
Evidence of Strategic Adjustment: Baby Notches

Australia

In May 2004 Australia announced a $3,000 “baby bonus” for children born on or after July 1, 2004

More children born on July 1, 2004 in Australia than on any other single day in decades

Over 1000 births delayed, with over two hundred of them moved by a week or more

In the last week of June, 42% of births through pharmaceutical induction or Cesarean

In the first week of July, 52%
OUTLINE

PEOPLE ADAPT

EFFICACY AND ADAPTATION
College Affordability
High Stakes Testing
Welfare to Work

COUNTERTERRORISM
Efficacy and Adaptation

People adapt to avoid policy

This limits efficacy and requires careful policy design

Sometimes adaptation also creates opportunities
OUTLINE

PEOPLE ADAPT

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COUNTERTERRORISM
FEDERAL FINANCIAL AID FOR COLLEGE GROWING OVER TIME
Cost to students only decreased by 30 cent for every dollar of aid

It is difficult for supply to expand

So universities can decrease internal aid and still attract students

Increased financial aid primarily benefits universities, rather than making college cheaper

This isn’t true at community colleges and technical schools, where supply can expand more easily
OUTLINE

PEOPLE ADAPT

EFFICACY AND ADAPTATION

College Affordability

High Stakes Testing

Welfare to Work

COUNTERTERRORISM
Educational Reform

Hold students, teachers, and schools accountable by evaluating based on standardized test scores

- NCLB
- Race to the Top

Adaptation to improved measurement and heightened incentives

- Get scores just above test thresholds
- Shift effort to test-relevant tasks
- Shift attention to students close to the test threshold
In NY, schools manipulated scores to make sure students passed.

Test Score Distributions for Core Regents Exams, 2004-2010

Total Manipulation = 5.81 (0.04)
In-Range Manipulation = 44.53 (0.26)

Notes: This figure shows the test score distribution around the 55 and 65 score cuts for New York City high school test takers between 2004-2010. Core exams include English Language Arts, Global History, U.S. History, Math A/Integrated Algebra, and Living Environment. We include the first test in each subject for each student in our sample. Each point shows the fraction of test takers in a score bin with solid points indicating a manipulable score. The dotted line beneath the empirical distribution is a subject specific sixth-degree polynomial fitted to the empirical distribution excluding the manipulable scores near each cut. Total manipulation is the fraction of test takers with manipulated scores. In-range manipulation is the fraction of test takers with manipulated scores normalized by the average height of the counterfactual distribution to the left of each cut. Standard errors are calculated using the parametric bootstrap procedure described in the text. See the data appendix for additional details on the sample and variable definitions.
In Chicago, schools changed focus to topics on the test.

Figure 3. Achievement trends in Chicago vs. other large, urban school districts in the Midwest, 1990–2000. The achievement series for large Midwestern cities includes data for all tested elementary grades in Cincinnati, Gary, Indianapolis, St. Louis and Milwaukee. The sample includes all grades from 3 to 8 for which test score data was available, and only includes students whose test scores were reported. Test scores are standardized separately by grade*subject*district, using the student-level mean and standard deviation for the earliest available year.

Math Achievement Trends

Reading Achievement Trends
In Chicago, teachers focused attention on students “on the bubble” in 5th grade when it was low stakes. But the students who were in fifth grade in 2002 took their second ISAT when it was high stakes.

Focus, for a moment, on students who were in 5th grade in 2001. One can calculate how much improvement different types of students showed from 3rd grade to 5th grade. For instance, you could group the students into 10 groups based on their scores in third grade. Then you could easily calculate how much students who were in the bottom decile (i.e., the bottom 10 percent) in 3rd grade improved by 5th grade, how much students who were in the 2nd decile (i.e., the 10th to 20th percentile) in 3rd grade improved by 5th grade, and so on for each decile. Doing so tells you, under low stakes testing, how much each type of student is expected to improve from 3rd grade to 5th grade.

Now, do this same thing for the students who were in 5th grade in 2002 when testing became high stakes. If teachers don’t change their behavior in response to high stakes testing, then you should expect to see the same pattern for these kids as you do for the 2001 kids. But if, once the test becomes high stakes, teachers focus their efforts on students who are on the cusp of passing the test, then you’d expect to see a different pattern between the 2001 and 2002 groups. In particular, you’d expect 2002 kids who were at the very bottom and very top of their 3rd grade classes to improve less than 2001 kids in those same positions, since starting in 2002 the teachers care less about them. You’d also expect 2002 kids who were in the middle of their 3rd grade class to improve more than 2001 kids in the middle of their 3rd grade class, since in 2002 teachers have more incentive to focus on these kids.

This is precisely what Neal and Schanzenbach find, as reflected in the following figures (taken from Neal and Schanzenbach).

A. Change in fifth-grade reading scores, 2002 versus 2001

B. Change in fifth-grade math scores, 2002 versus 2001
Outline

People Adapt

Efficacy and Adaptation
  College Affordability
  High Stakes Testing
  Welfare to Work

Counterterrorism
Welfare-to-Work reduced people on welfare

Families on welfare by year
Welfare-to-Work incentivized states to move people to disability

Low income people on disability by year
Outline

People Adapt

Efficacy and Adaptation
- College Affordability
- High Stakes Testing
- Welfare to Work

Counterterrorism
A Model of Optimal Counterterrorism

Two potential targets: $A$ and $B$

$\alpha \in [0, 1]$ is government resources devoted to protecting $A$ and $\beta \in [0, 1]$ is government resources devoted to defending $B$

$\alpha + \beta = 1$

Terrorists choose to attack one or the other target.

If resources $x$ spent protecting a given target, then the probability of an attack on that target succeeding is $1 - x$

Terrorists value two targets equally
Terrorist Best Response

If the government chose $\alpha > \frac{1}{2}$, terrorists’ best response is to attack target $B$.

If government chose $\alpha < \frac{1}{2}$, terrorists’ best response is to attack target $A$.

If government chose $\alpha = \frac{1}{2}$, terrorists are indifferent between attacking $A$ or $B$. 
Optimal Counterterrorism

If the government expends more resources protecting one target than another, those resources are entirely wasted because the terrorists adjust, attacking the other target.

The best the government can do is divide its resources evenly between two targets.

Strategic adjustment by terrorists forces the government to spread resources thin.
Optimal counterterrorism policy is not responsive to how much the government cares about the two targets

It is a mistake to particularly defend targets that are of high value to the government
**Implications 2**

Optimal counterterrorism policy is responsive to how much the terrorists care about the two targets.

Suppose the value to the terrorists of the two targets is $v_A$ and $v_B$. The terrorists strictly prefer to attack $A$ if:

$$
(1 - \alpha)v_A > (1 - \beta)v_B
$$

$$
\alpha < \frac{v_A}{v_A + v_B}.
$$

Government again spreads resources thin, but weighted by how much the terrorists care about each target to equalize expected value of attacking each target.
Implications 3

If there are lots of targets, the problem is even starker

Algorithm for optimal counterterrorism policy:

- Start by spending on the target considered most valuable by the terrorists
- Keep spending until its expected value as a target is equal to the second most valuable target
- Then spend on both of those until they are both equal to the third most valuable target
- Then spend on all three of those until they are all equal to the fourth most valuable target
- Continue this process until you are out of money
Worldwide Skyjackings per Quarter, 1968-1977

Horizontal line is average incidents per quarter before and after 1973:Q1
**General Lessons**

You have to think about the behavior of the people your policy is targeted at.

Adaptation limits efficacy.
War on Drugs

Caribbean share
- 1985: 75%
- 1992: 10%

Mexican Share
- 1989: 33%
- 1992: 50%
- 1998: 80%
A Proposal for Ending Drug Violence in Mexico

6 major drug trafficking organizations

Mexican government crafts a public measure of how violent each organizations is

United States and Mexican governments target all drug enforcement resources on the single most violent organization

Only way to avoid being targeted is to not be most violent
  - Creates a race to the bottom

Could eliminate violence, but would not disrupt drug trafficking
Take Aways

People adapt in response to policy changes.

In order to anticipate the effect of a policy change, one must take into account how behavior will change.

Nonetheless, adaptation limits the efficacy of policy.

Try to find policies that target the broadest category of behavior your policy is aimed at.

- Tax on carbon rather than implement CAFE standards.
- Increase intelligence rather than airport security.
A Question to Ponder

In light of strategic adjustment, do you believe building grocery stores in food deserts will improve the welfare of the poor residents of those neighborhoods?