# Are better informed customers better? Lessons from a laboratory experiment

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- **Who cares?**

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- **Problem**: How to answer this question?
- **Solution**: Economic Experiment!
- **Benefits**: Many
- **Who cares?** Demand response is becoming increasingly important.

**Research Questions:**

1. What is the effect of feedback on consumption and price responsiveness?
2. How does the effect of feedback change when the rate structure changes?

# Experimental Design:

**Experimental Design:**

- Need to capture the essential features of the setting

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- Need to capture the essential features of the setting
- HH water/energy use $\Rightarrow$ Decision-making under uncertainty with imperfect information

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- Participant characteristics: Survey and Risk Preference Test

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- Why no water? Why no electricity?

# Feedback Treatment

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1. Review of Output and Revenue + Input Use Information

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*After* each decision a participant sees one of two possible weekly feedback screens:

1. Review of Output and Revenue + Input Use Information
2. Review of Output and Revenue + NO Input Use Information

**This is Week 2 of Month 2**

**Summary of Week 2 Results**

| Revenue Summary | |
|---|---|
| You chose to produce the following number of outputs | **6** |
| Your revenue from this week's production is | **72** lab dollars |

| Input Use Summary | |
|---|---|
| This week's input requirements were | **Low** |
| This week, to produce one ouput, the following number of inputs were required | **2** |
| This week, in producing **6** units of output, you used | **12** total inputs |

| So far this month... | |
|---|---|
| As of right now, the combined total number of inputs used this week and the previous week(s) in this month are | **24** |

**This is Week 2 of Month 1**

**Summary of Week 2 Results**

| Revenue Summary | |
|---|---|
| You chose to produce the following number of outputs | **6** |
| Your revenue from this week's production is | **72** lab dollars |

| Input Use Summary | |
|---|---|
| This week's input requirements were | Information not available this week. |
| This week, to produce one ouput, the following number of inputs were required | Information not available this week |
| This week, in producing **6** units of output, you used | Information not available this week |

| So far this month... | |
|---|---|
| As of right now, the combined total number of inputs used this week and the previous week(s) in this month are | Information not available this week |

# Rate Structure Treatment

## Rate Structure Treatment

Three different rate structures

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1. Constant Marginal Price (CMP)

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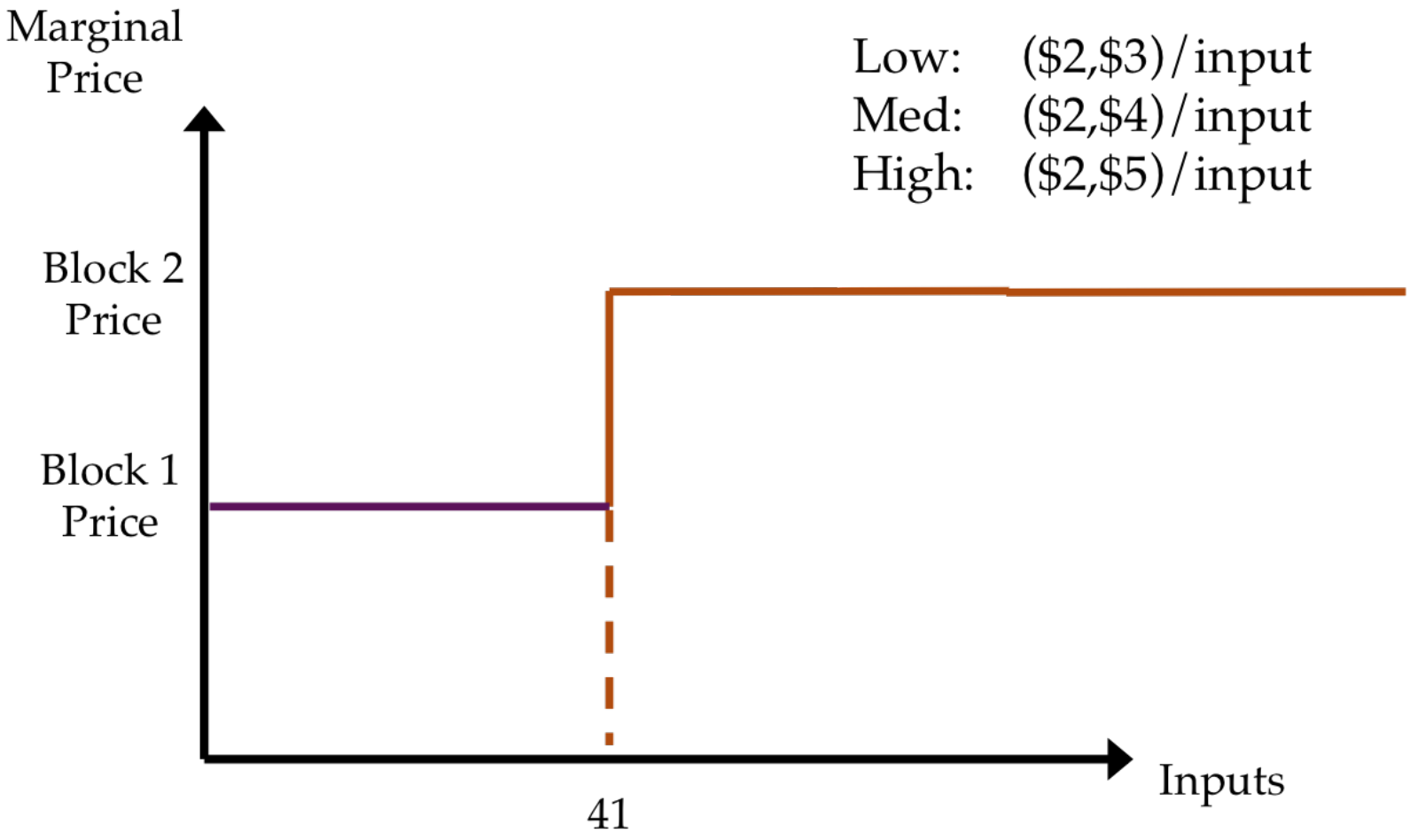
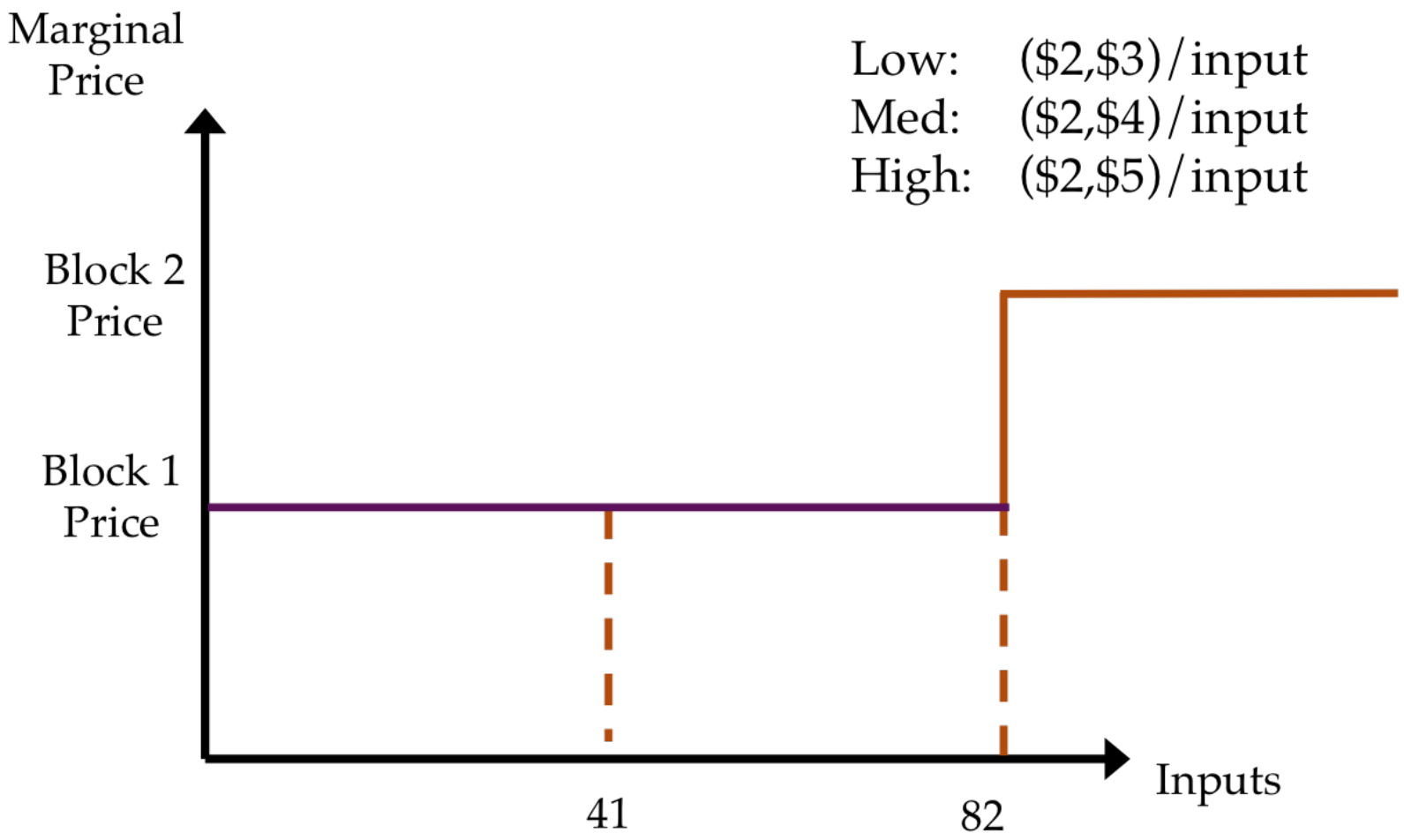
Three different rate structures

1. Constant Marginal Price (CMP)
2. Increasing Block Rate with threshold at 41 inputs (IBR41)
3. Increasing Block Rate with threshold at 82 inputs (IBR82)

Low: $2/input
Med: $3/input
High: $4/input


Marginal Price
Block 2 Price
Block 1 Price
41
Inputs
Low: ($2,$3)/input
Med: ($2,$4)/input
High: ($2,$5)/input


Marginal Price
Low: ($2,$3)/input
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Block 2 Price
Block 1 Price
41
82
Inputs

# Organization of Sessions

Table : Experiment Timeline

Timing of Prices and Feedback

| Month | Price Level | Session A | Session B |
|---|---|---|---|
| 1 | Low | | Weekly Feedback |
| 2 | Low | Weekly Feedback | |
| 3 | High | Weekly Feedback | |
| 4 | High | | Weekly Feedback |
| 5 | Medium | | Weekly Feedback |
| 6 | Medium | Weekly Feedback | |
| 7 | Low | Weekly Feedback | |
| 8 | Low | | Weekly Feedback |
| 9 | High | | Weekly Feedback |
| 10 | High | Weekly Feedback | |
| 11 | Medium | Weekly Feedback | |
| 12 | Medium | | Weekly Feedback |

**Results**:

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- Feedback increases monthly variation in output choices

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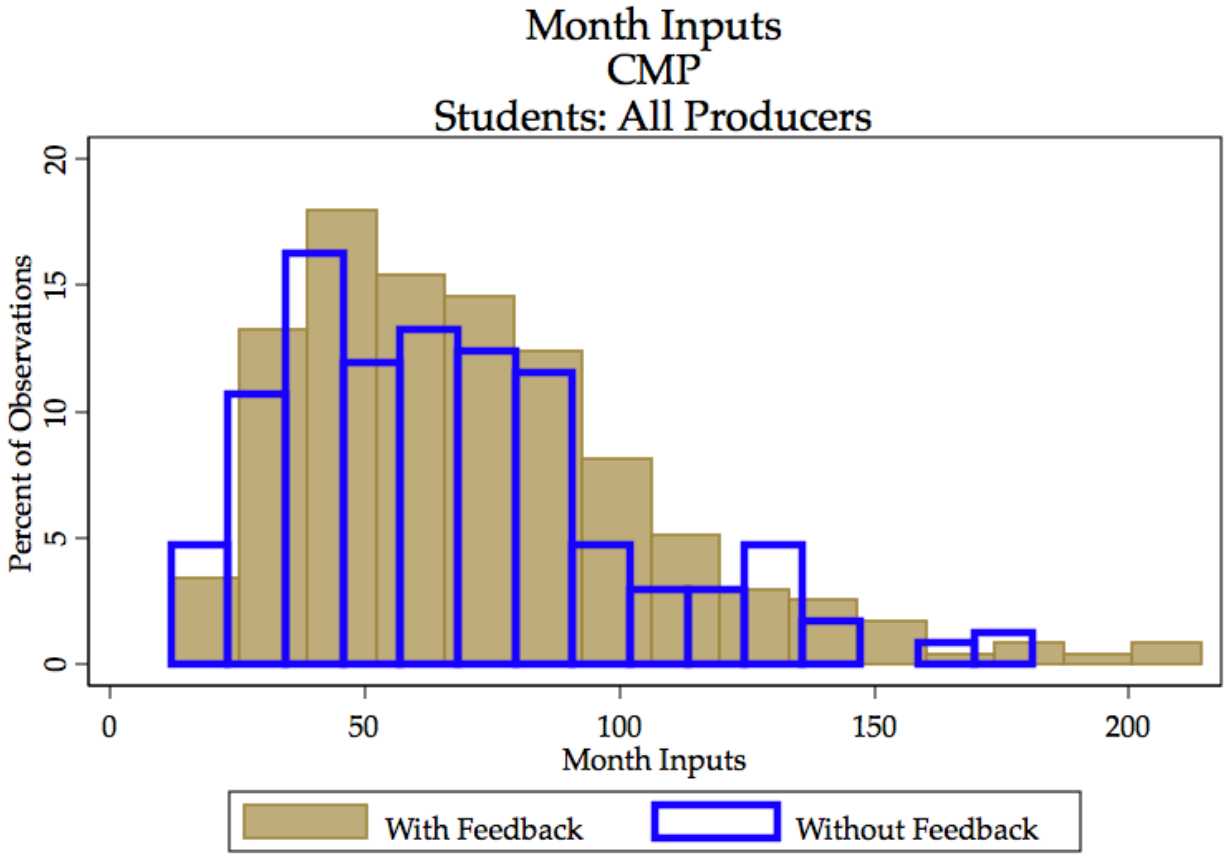
- Feedback increases average monthly input demand
- Feedback increases monthly variation in output choices
- Feedback reduces price responsiveness*

## Average Inputs per Person per Month

| | Students | | | Practitioners |
|---|---|---|---|---|
| | CMP | IBR41 | IBR82 | IBR82 |
| Average inputs per person per month | 69.4 | 76.5 | 81.9 | 80.9 |
| Without Feedback | 69.1 | 74.9 | 81.2 | 79.7 |
| With Feedback | 69.7 | 78.1 | 82.5 | 83.4 |

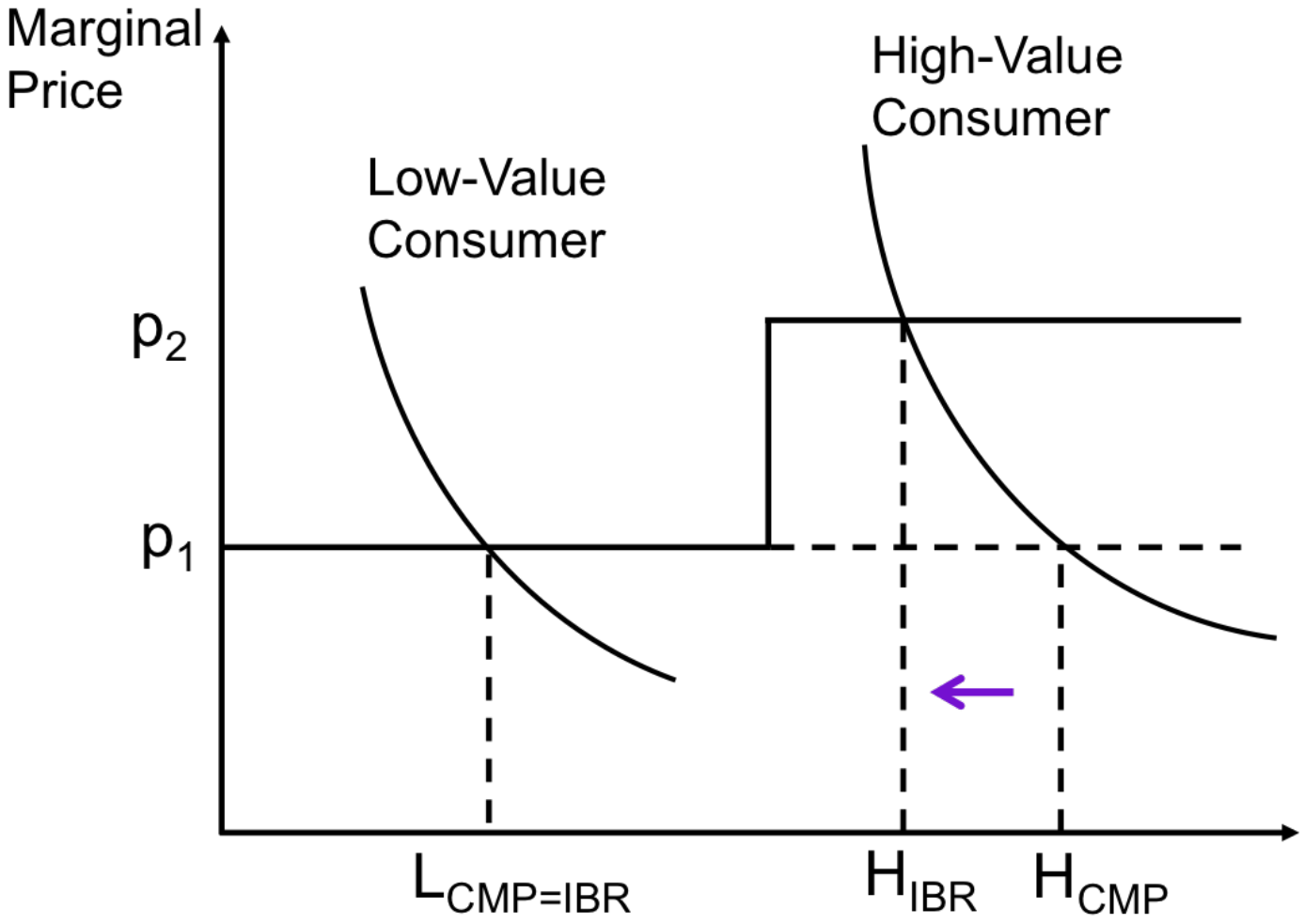

Month Inputs
CMP
Students: All Producers
Percent of Observations
0
5
10
15
20
0
50
100
150
200
Month Inputs
With Feedback
Without Feedback

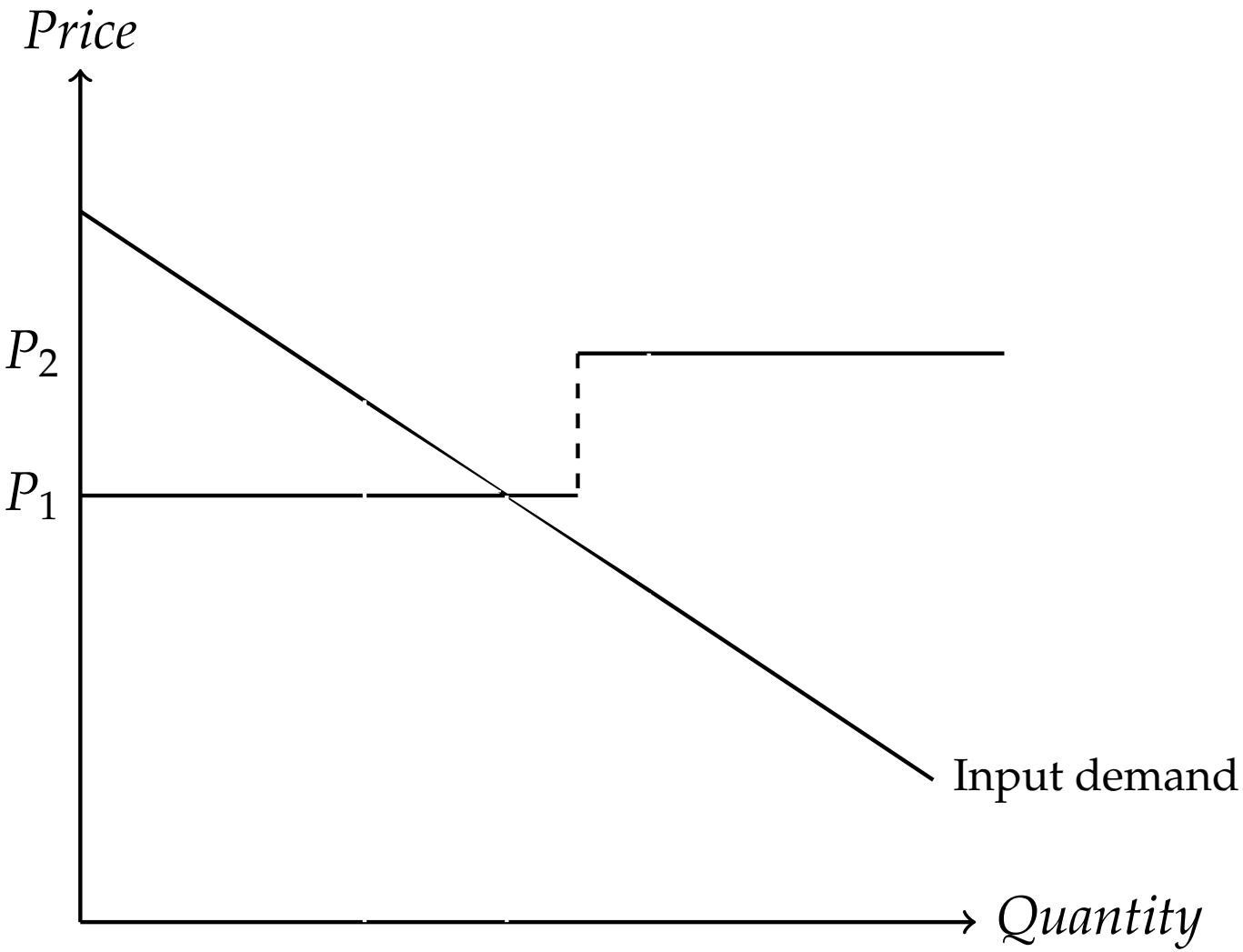
Feedback + Rate Structure

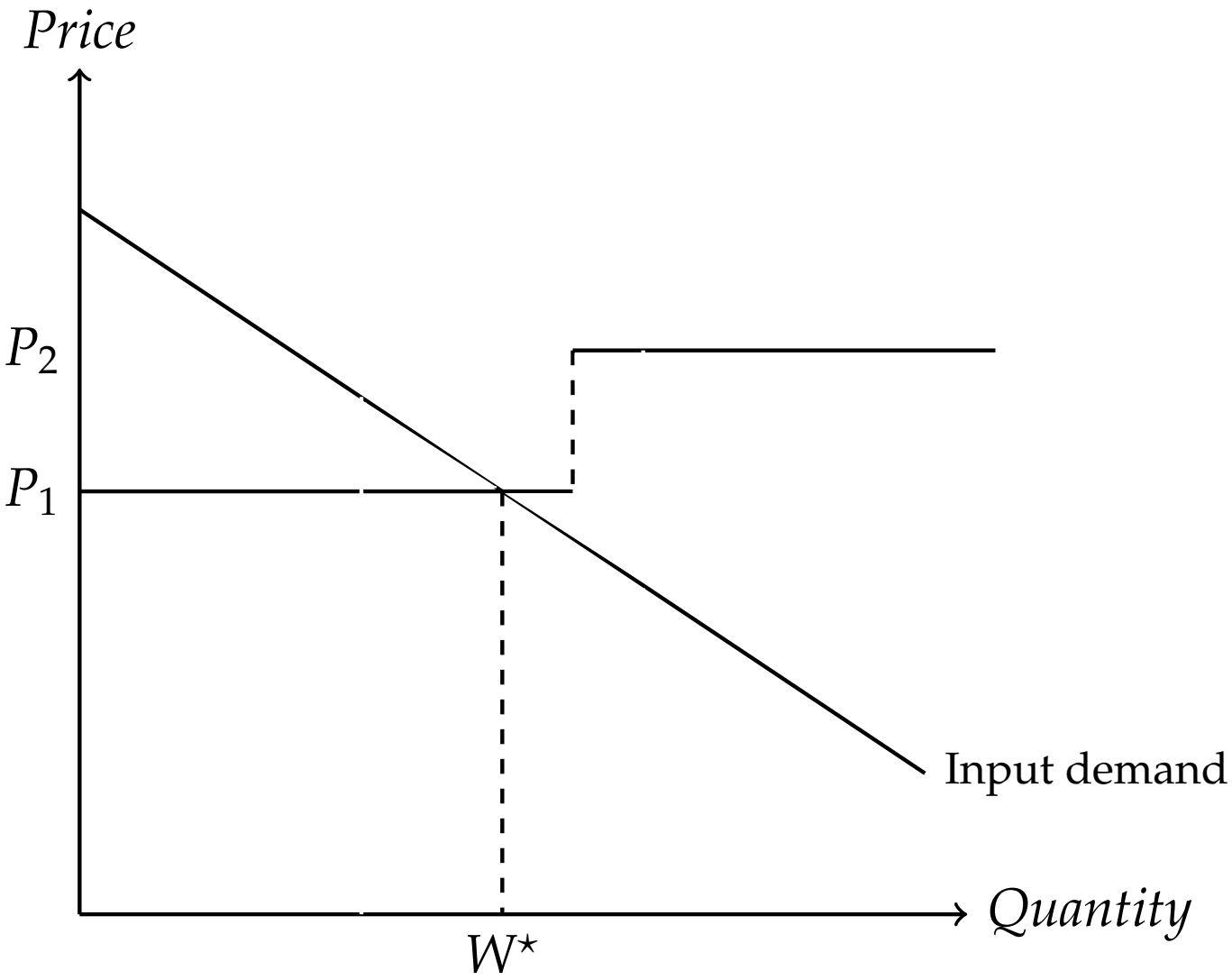
- Price responsiveness increases when more participants are impacted by price changes
- Feedback responsiveness increases when input demand gets closer to pricing threshold

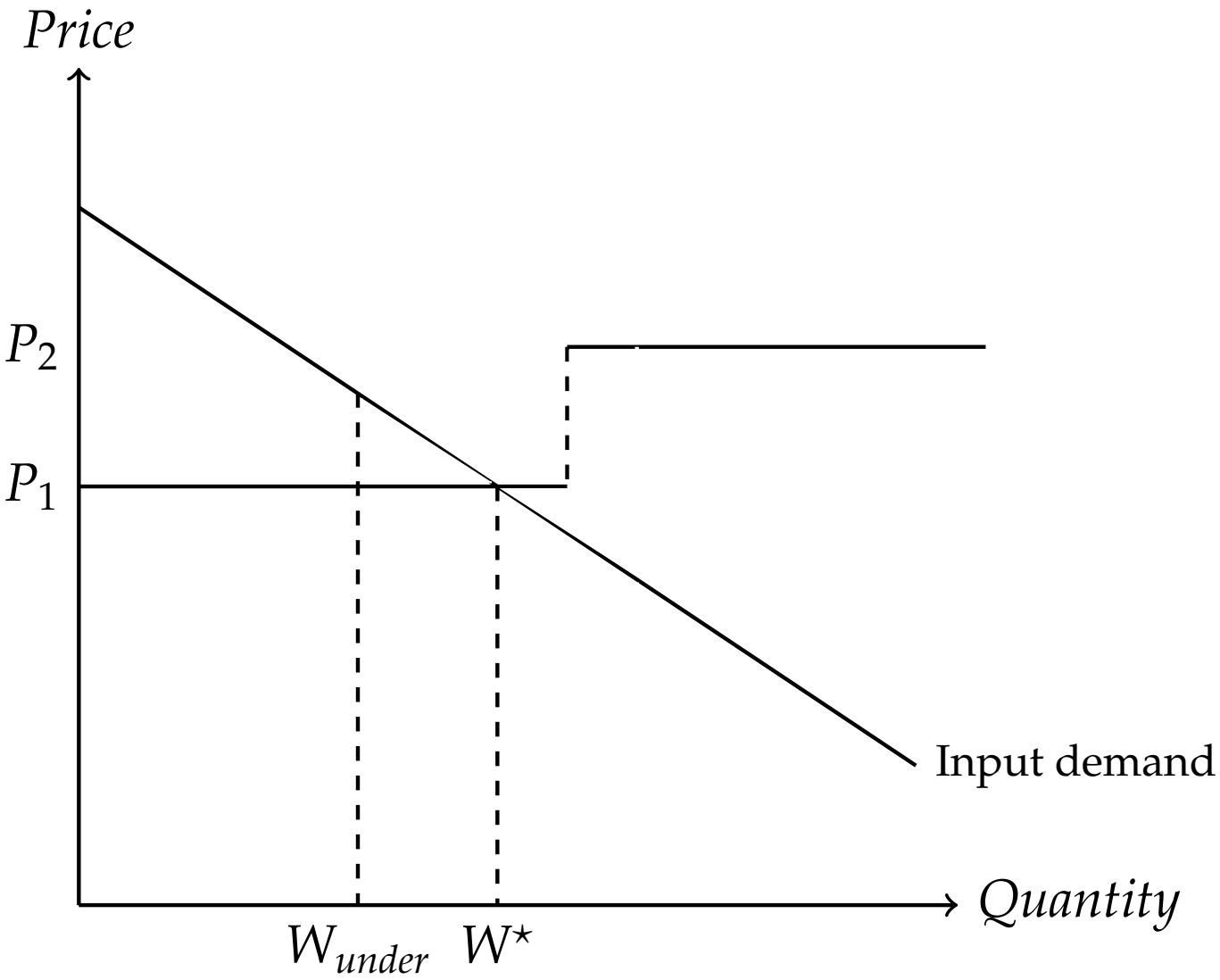
# Increasing Block Rate sessions: How do participants adjust from week to week?

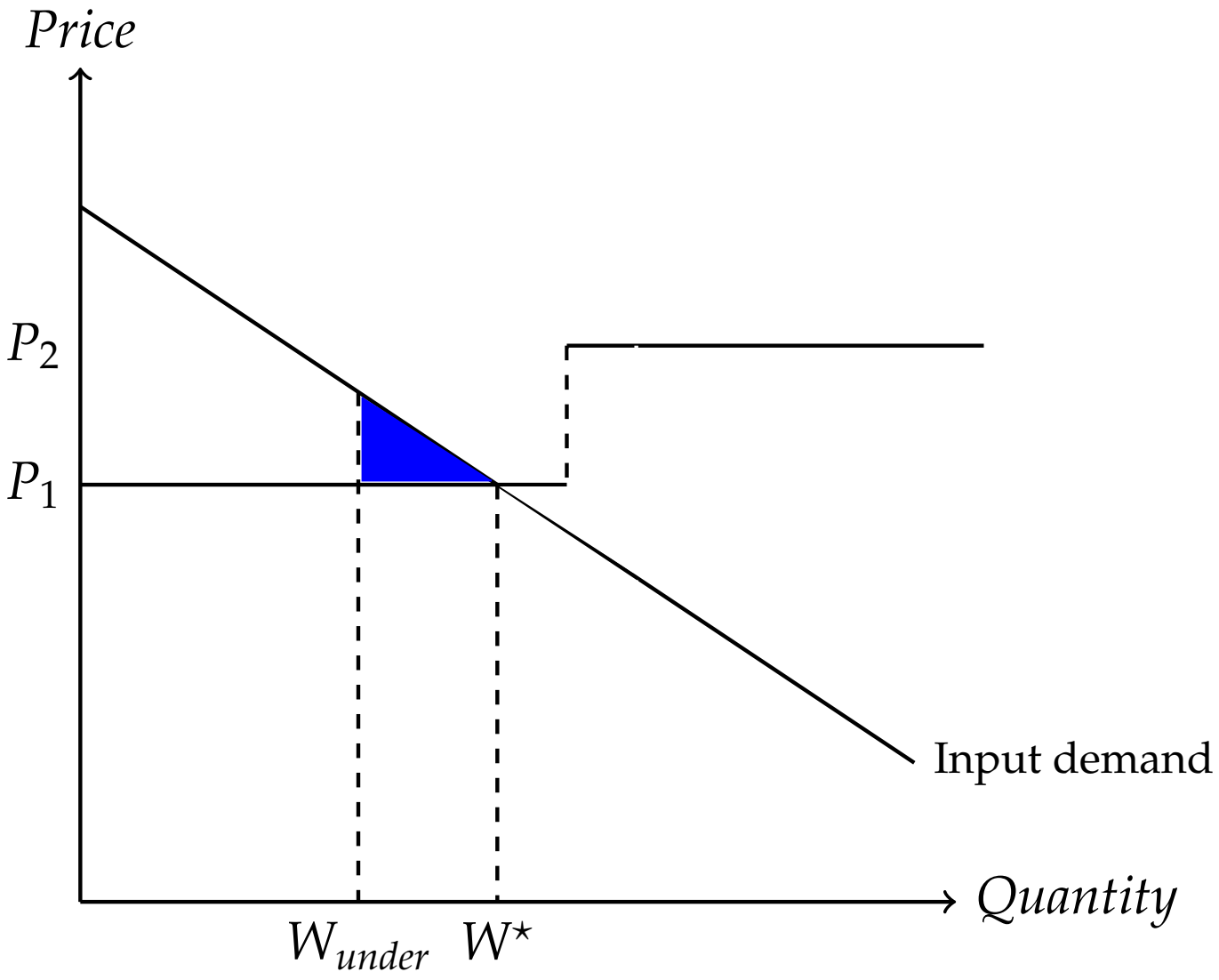
| | Feedback | Week Output |
|---|---|---|
| Effect of Feedback | Learn Inputs use is **Below** Boundary | ↑ |
| | Learn Input use is **Above** Boundary | ↓ |

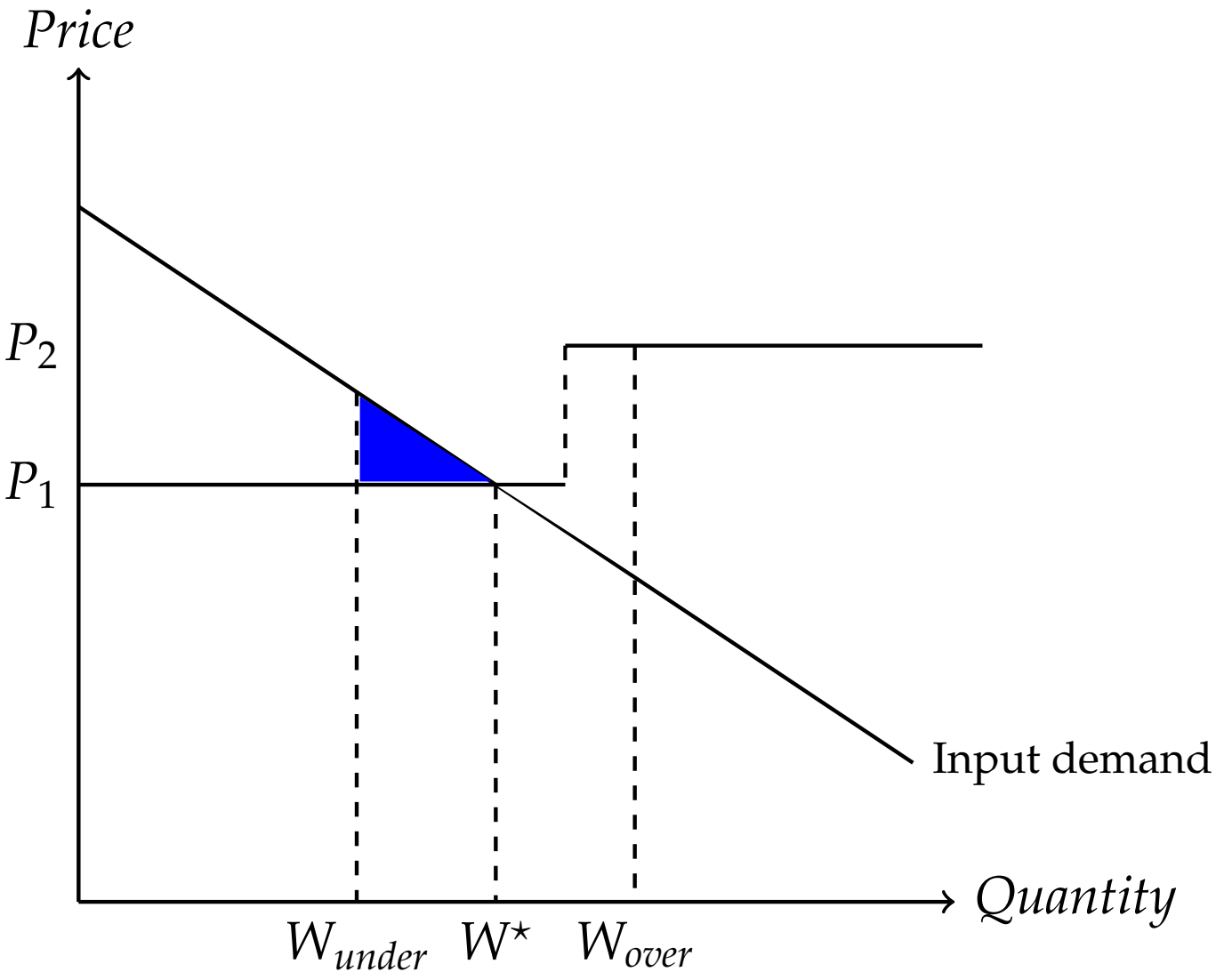

Marginal Price
High-Value Consumer
Low-Value Consumer
$p_2$
$p_1$
$L_{CMP=IBR}$
$H_{IBR}$
$H_{CMP}$


Price
$P_2$
$P_1$
Input demand
Quantity


Price
$P_2$
$P_1$
Input demand
Quantity
$W^\star$


Price
$P_2$
$P_1$
Input demand
Quantity
$W_{under}$
$W^\star$


Price
$P_2$
$P_1$
Input demand
Quantity
$W_{under}$
$W^\star$


Price
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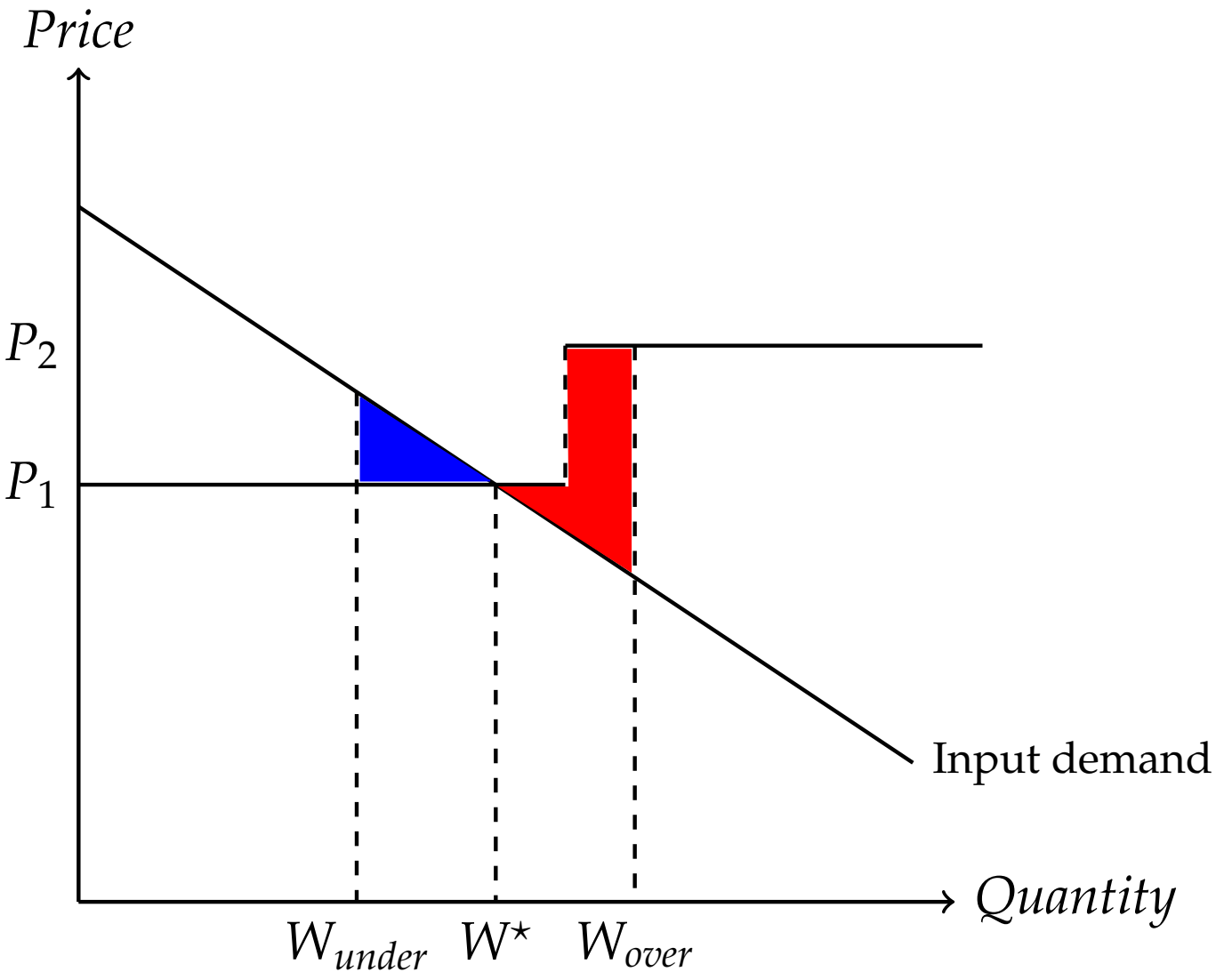
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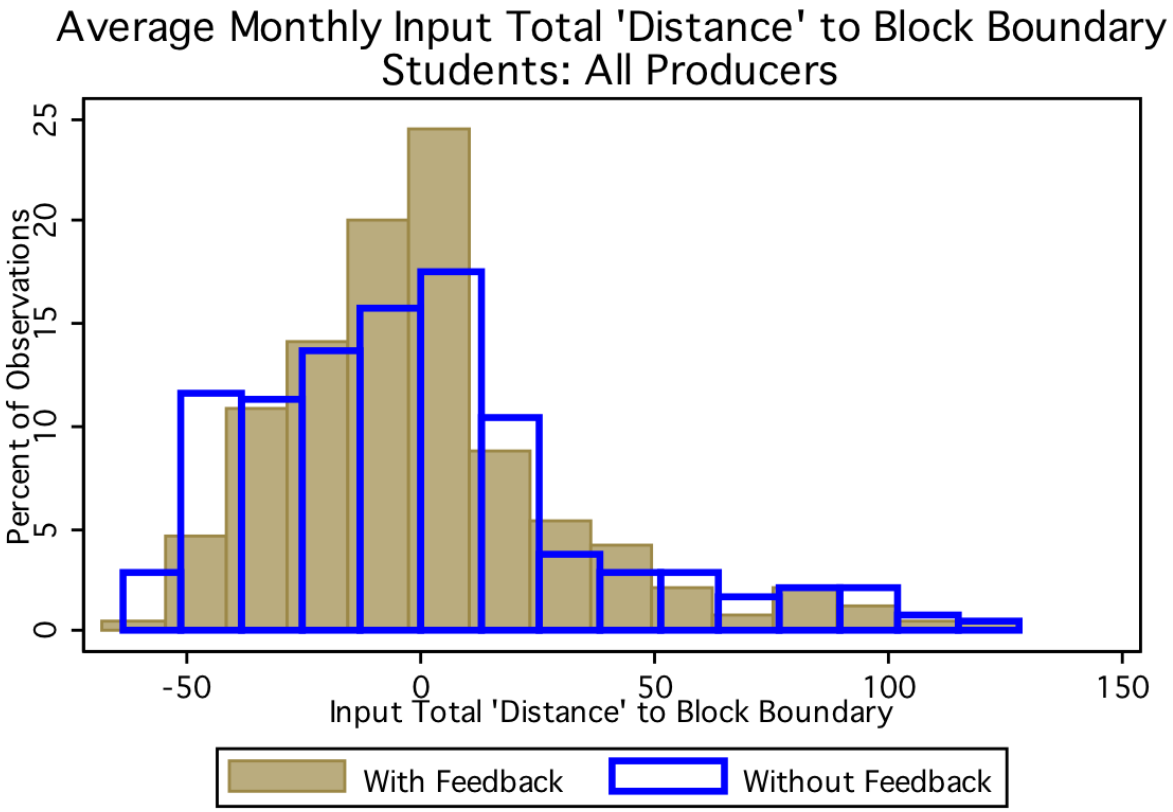
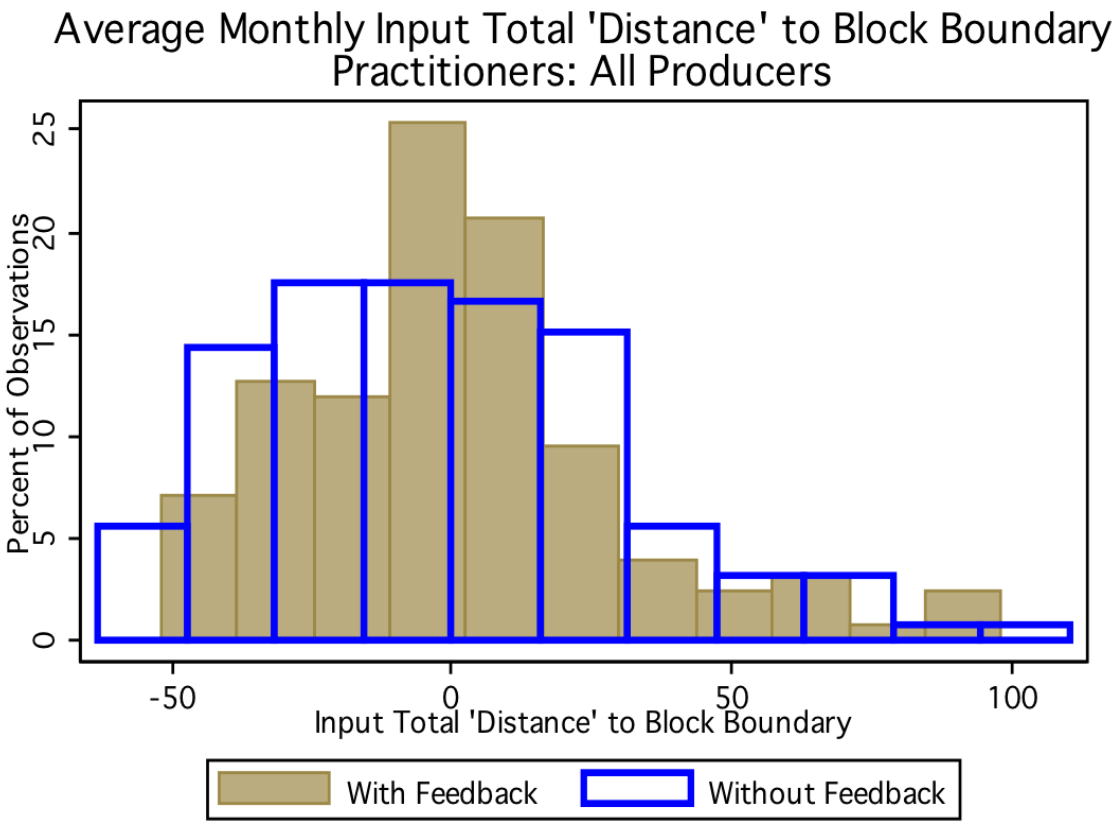
- Consider monthly input "distance" to block boundary...


Average Monthly Input Total 'Distance' to Block Boundary
Students: All Producers
Percent of Observations
0
5
10
15
20
25
-50
0
50
100
150
Input Total 'Distance' to Block Boundary
With Feedback
Without Feedback


Average Monthly Input Total 'Distance' to Block Boundary
Practitioners: All Producers
Percent of Observations
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5
10
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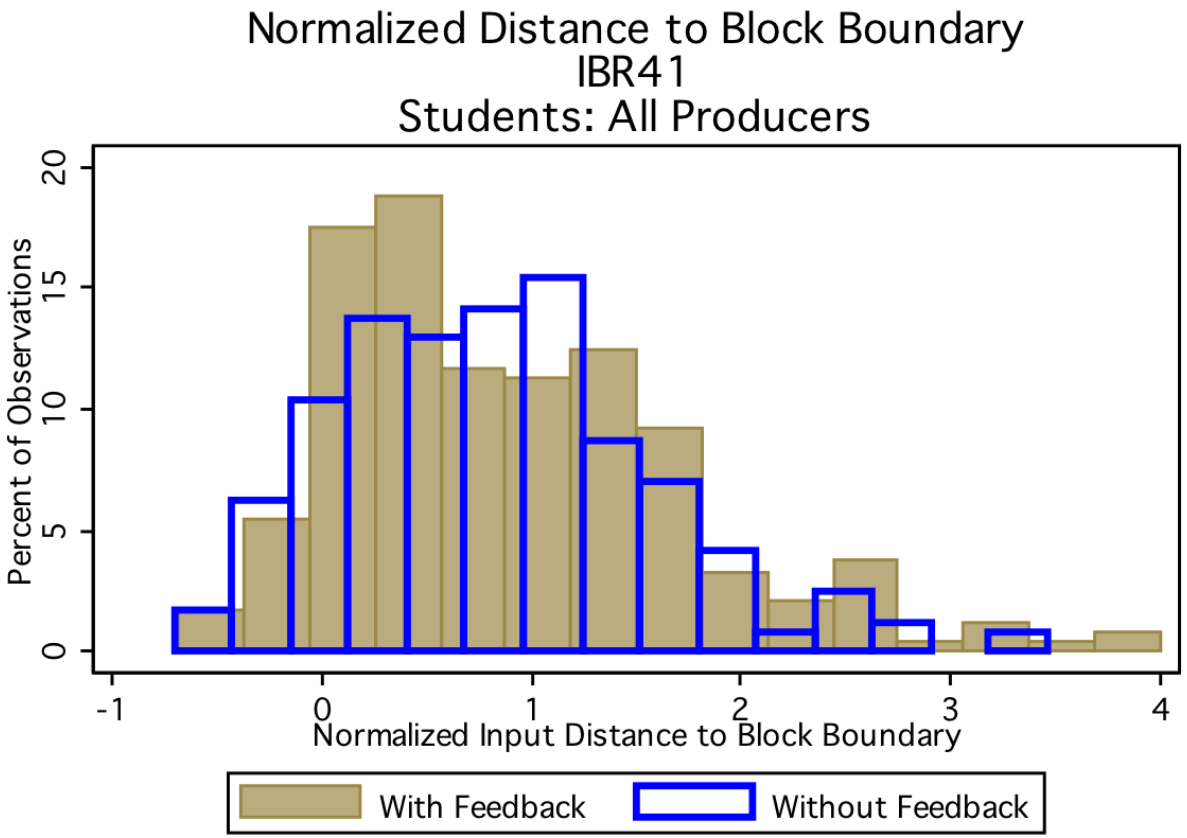
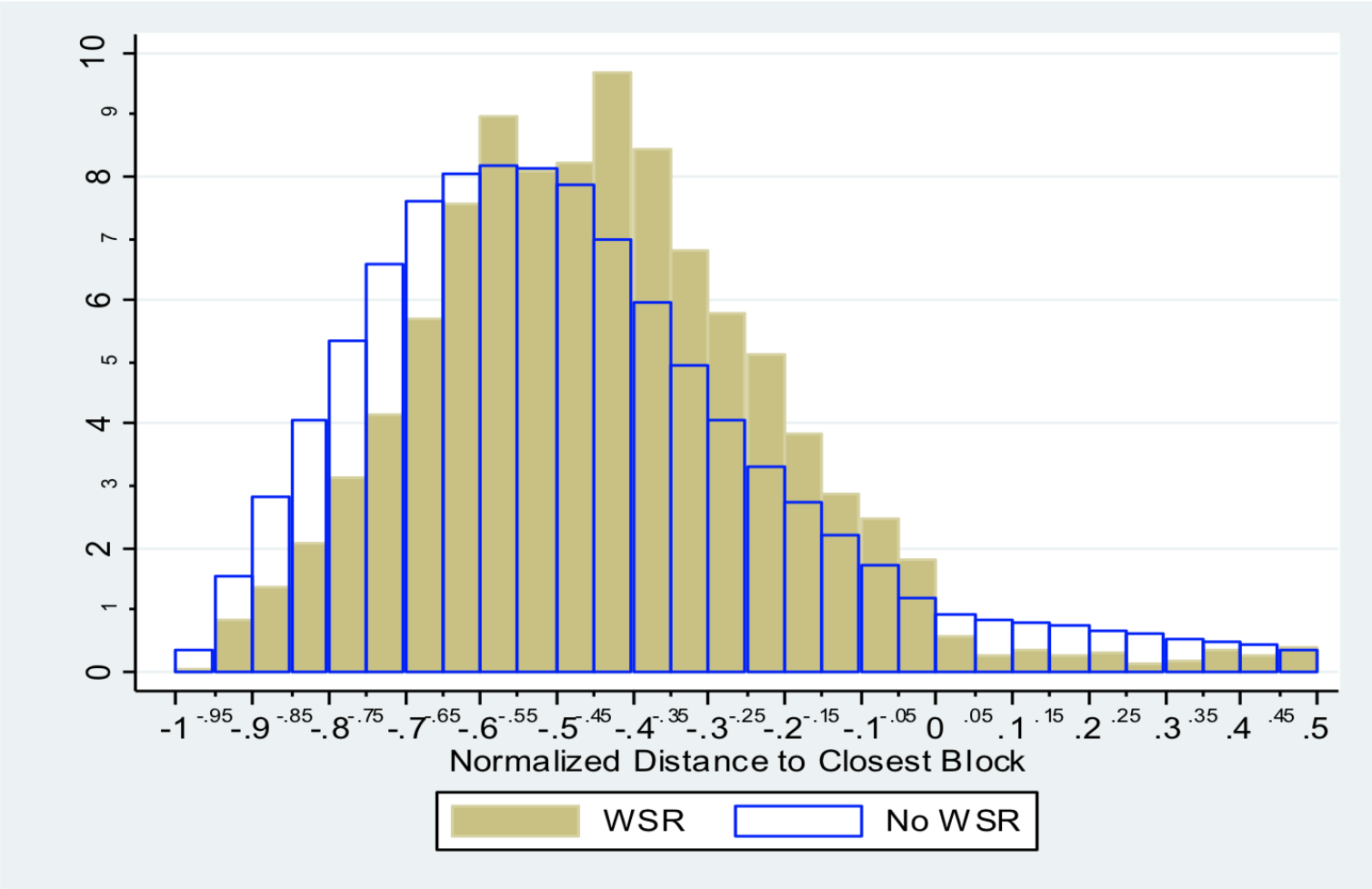
25
-50
0
50
100
Input Total 'Distance' to Block Boundary
With Feedback
Without Feedback


Normalized Distance to Block Boundary
IBR41
Students: All Producers
Percent of Observations
0
5
10
15
20
-1
0
1
2
3
4
Normalized Input Distance to Block Boundary
With Feedback
Without Feedback

# From a Water Smart Reader (WSR) study in Aurora, CO



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  - Some said it was harder to make choices with weekly feedback
  - These participants did worse with weekly feedback

Some practitioner comments:

- "What good will it be to learn about the inputs after the fact?"
- "I used weekly feedback to make decisions for future weeks, avoiding going over 82 units"
- "I attempted average level of production when no feedback was available"
- "I approached the experiment as if I were a business owner. I wanted to know more about cost of the inputs"

# Lessons Learned

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- Feedback may undo some of the benefits of an IBR

## Additional Advice:

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- Payouts need to be tied to performance
- Minimize bias coming into the experiment
- Maximize information gained from participants
  - Discuss hypotheses and possible drivers early and often

Experiments are a flexible, cost-effective tool
to help improve understanding of customer behavior.

# Questions?

Thanks!

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**Theoretical Predictions**:

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  Risk Neutral:

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**Theoretical Predictions**:

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  the rate structure and risk preferences

- CMP

  Risk Averse: $\Uparrow$
  Risk Neutral: $-$
  Risk Seeking: $\Downarrow$

- IBR

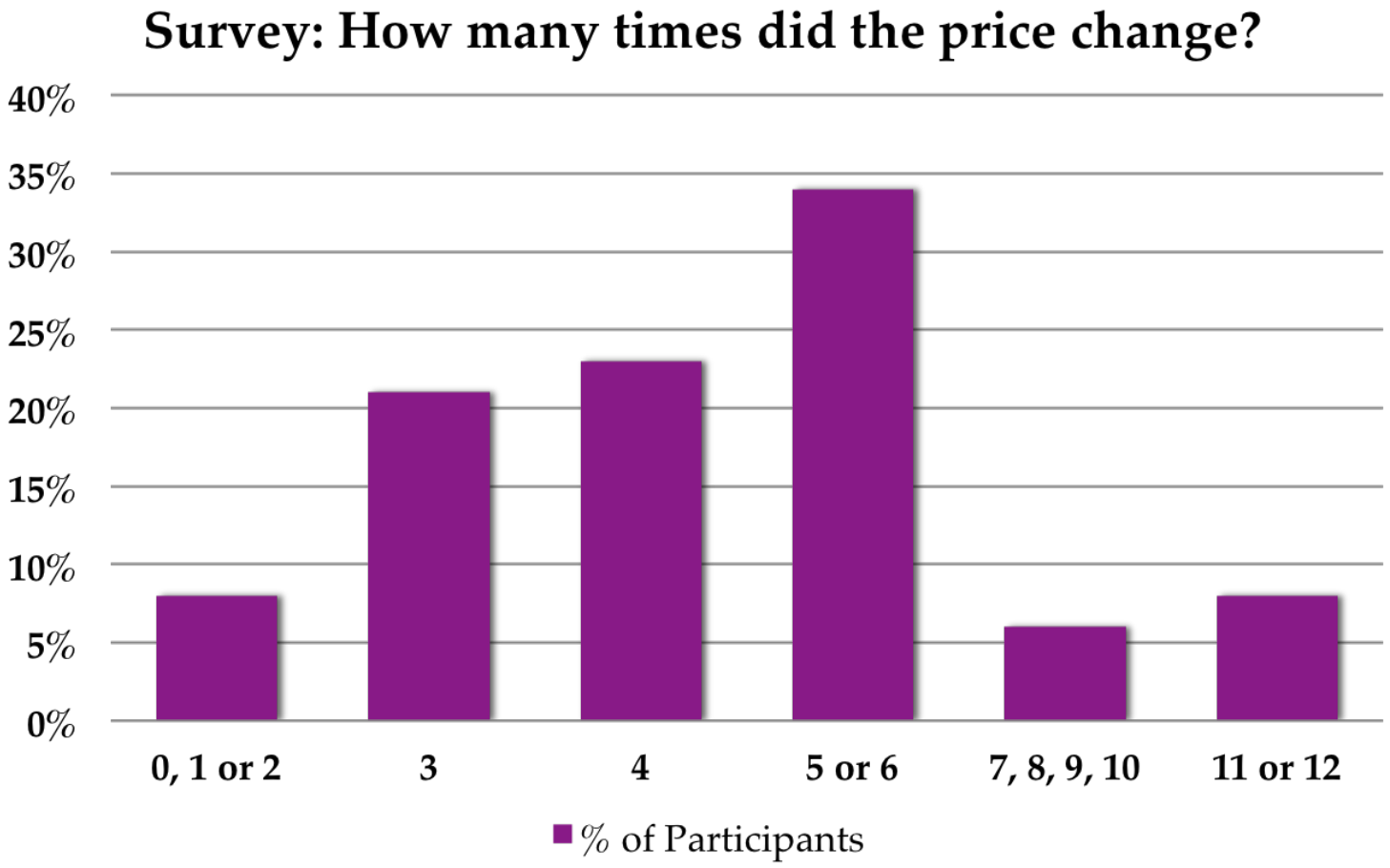
  + Rate structure induces behavior consistent with risk preference behavior

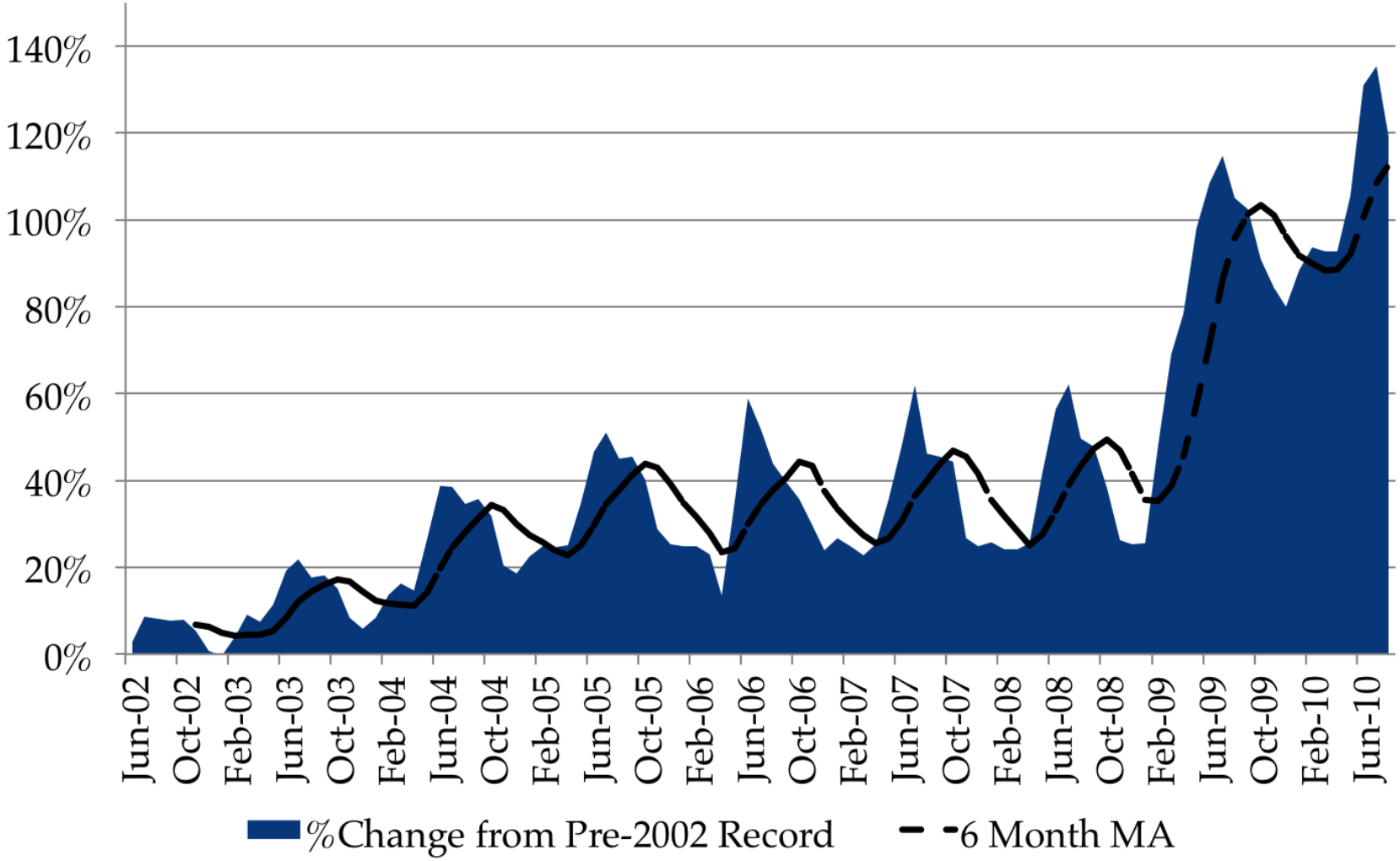
Does feedback improve decision-making?

- Sometimes
  - From the survey:
    ⇒ Some said it was harder to make choices with weekly feedback
    ⇒ These participants did worse with weekly feedback

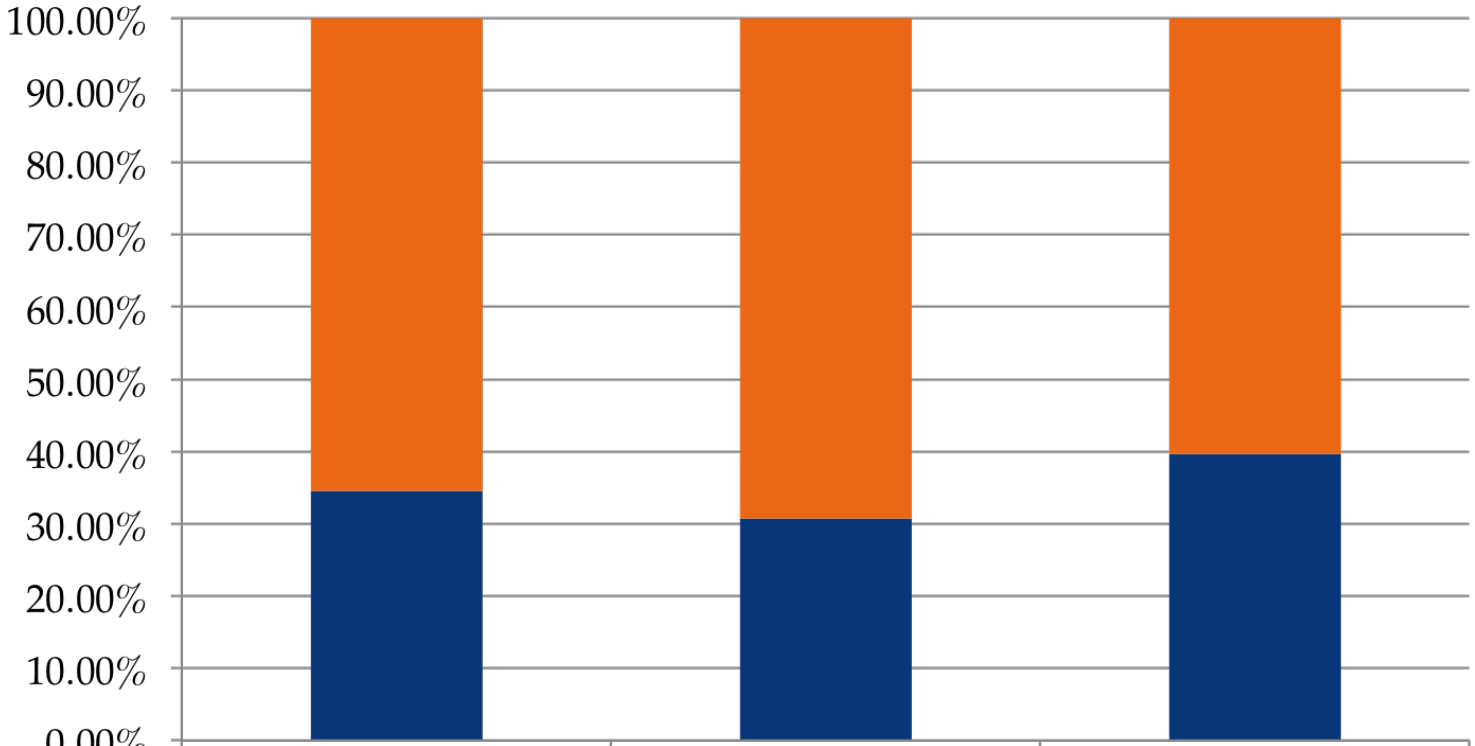
Real world connections

0
1
Percent
0
10
20
30
0
5
10
15
Number of Price Changes
Graphs by employee

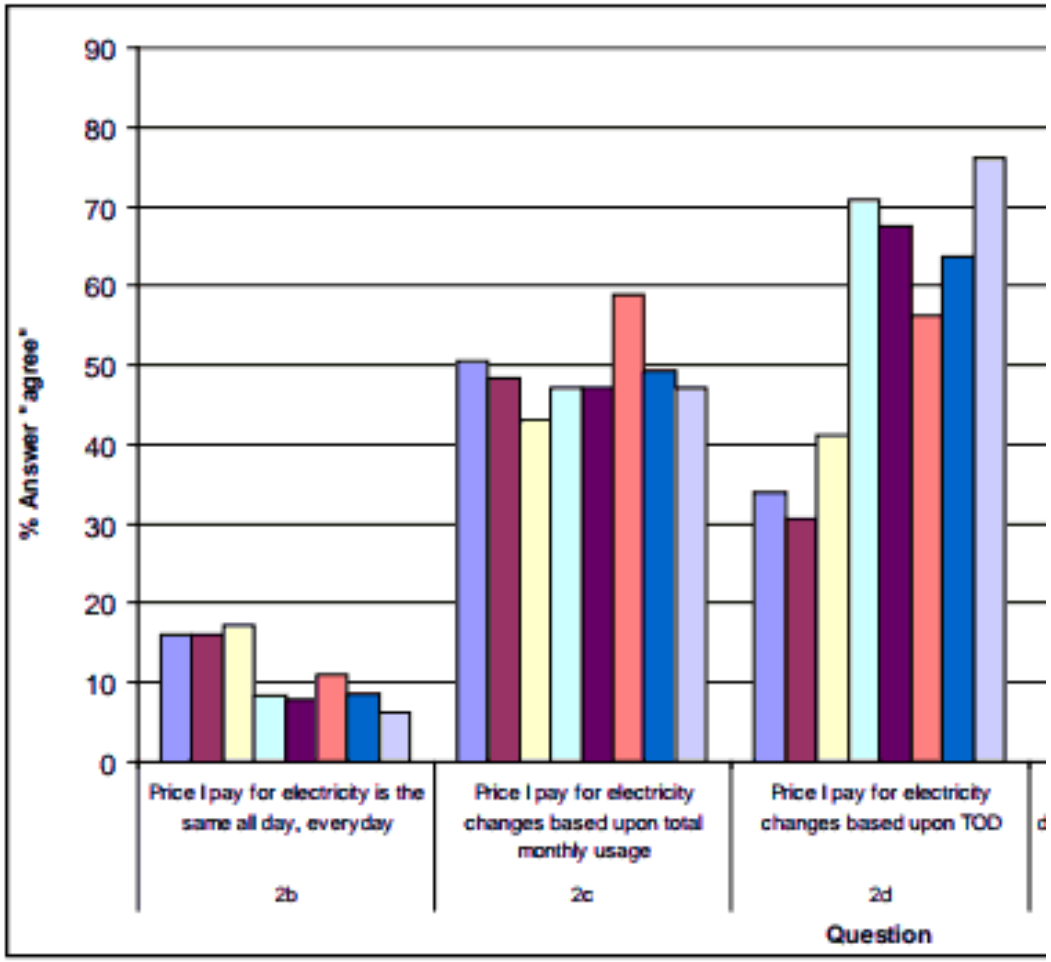

Survey: How many times did the price change?
40%
35%
30%
25%
20%
15%
10%
5%
0%
0, 1 or 2
3
4
5 or 6
7, 8, 9, 10
11 or 12
% of Participants


140%
120%
100%
80%
60%
40%
20%
0%
Jun-02
Oct-02
Feb-03
Jun-03
Oct-03
Feb-04
Jun-04
Oct-04
Feb-05
Jun-05
Oct-05
Feb-06
Jun-06
Oct-06
Feb-07
Jun-07
Oct-07
Feb-08
Jun-08
Oct-08
Feb-09
Jun-09
Oct-09
Feb-10
Jun-10
%Change from Pre-2002 Record
6 Month MA

## Are you aware of any recent changes in your water service or water price?




| | All Years | 2009 | 2010 |
|---|---|---|---|
| No | 65.43% | 69.25% | 60.33% |
| Yes | 34.57% | 30.75% | 39.67% |




Back to results