Discussion of Johnston "Real and Nominal Frictions within the Firm: how Lumpy Investment Matters for Price Adjustment"

Matteo Iacoviello
Boston College

- Real world observation: The cost of adjusting prices and capital is non-convex in nature: at the firm level, this makes changes in prices rare (and large) and investment lumpy (and large).

- Conventional ways of modelling costly price and capital adjustment ignore these non-convexities (mostly because of technical difficulties), and are somewhat inconsistent with micro/real world evidence.

- Practical men are usually slaves of some trick:

  – For prices, they assume that firms can randomly change their prices only in some period which does not depend on how long ago prices were changed (this yields similar implications to those from a model with convex adjustment costs: Calvo-lumpiness=Rotemberg-convex)

  – For capital, they resort to models with convex adjustment costs (in traditional NK models, this yields similar implications to those from a model with Calvo-style-lumpy capital adjustment Abel-Hayashi=Sveen-Weinke)

- This paper: takes the microeconomic appeal of lumpiness very seriously and introduces double lumpiness both in prices and in capital at the level of the firm.

  On top of this, it studies the general equilibrium implications of these features by considering aggregate responses of real and nominal variables to various shocks.
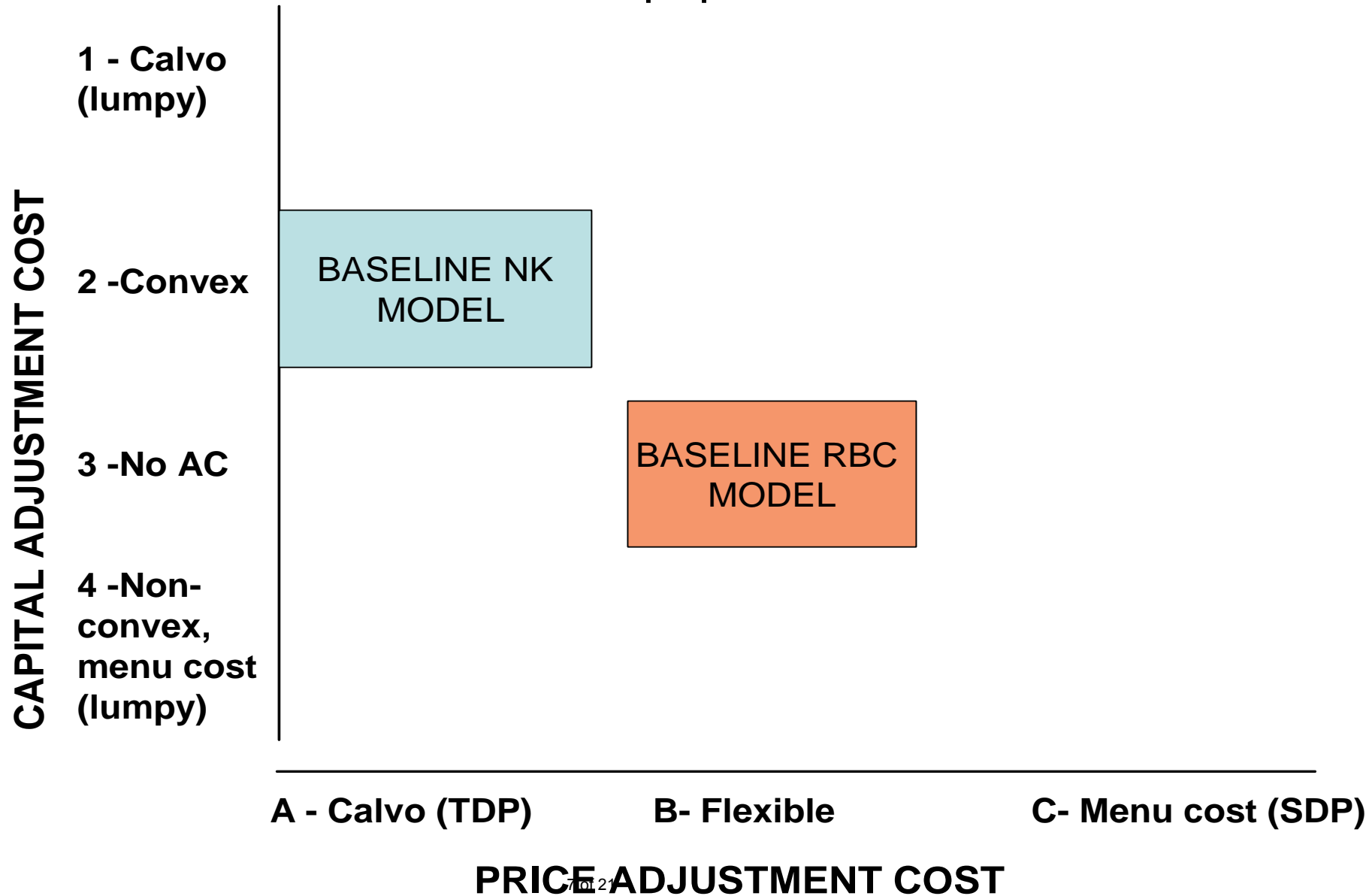
- THE MAIN QUESTION: How does the interaction between nominal and real lumpiness affect the sensitivity of real variables to real (technology) and nominal (money growth) disturbances?

- A LIST OF FINDINGS (as I see them): The double-lumpiness model has several intriguing properties:

1. Increases the sensitivity of inflation to all shocks and reduces the real effects of money relative to a baseline model without these features

2. Matches the dynamic cross-correlation between output and inflation ($corr\left(y_t, \pi_{t+k}\right) > 0$) better than model without these features

3. Shifts the action from consumption to investment in response to technology shocks, from investment to consumption in response to monetary shocks.

4. Delivers realistic hazard functions at firm-level (adjustment hazards for P and K rise with time since last adjustment)
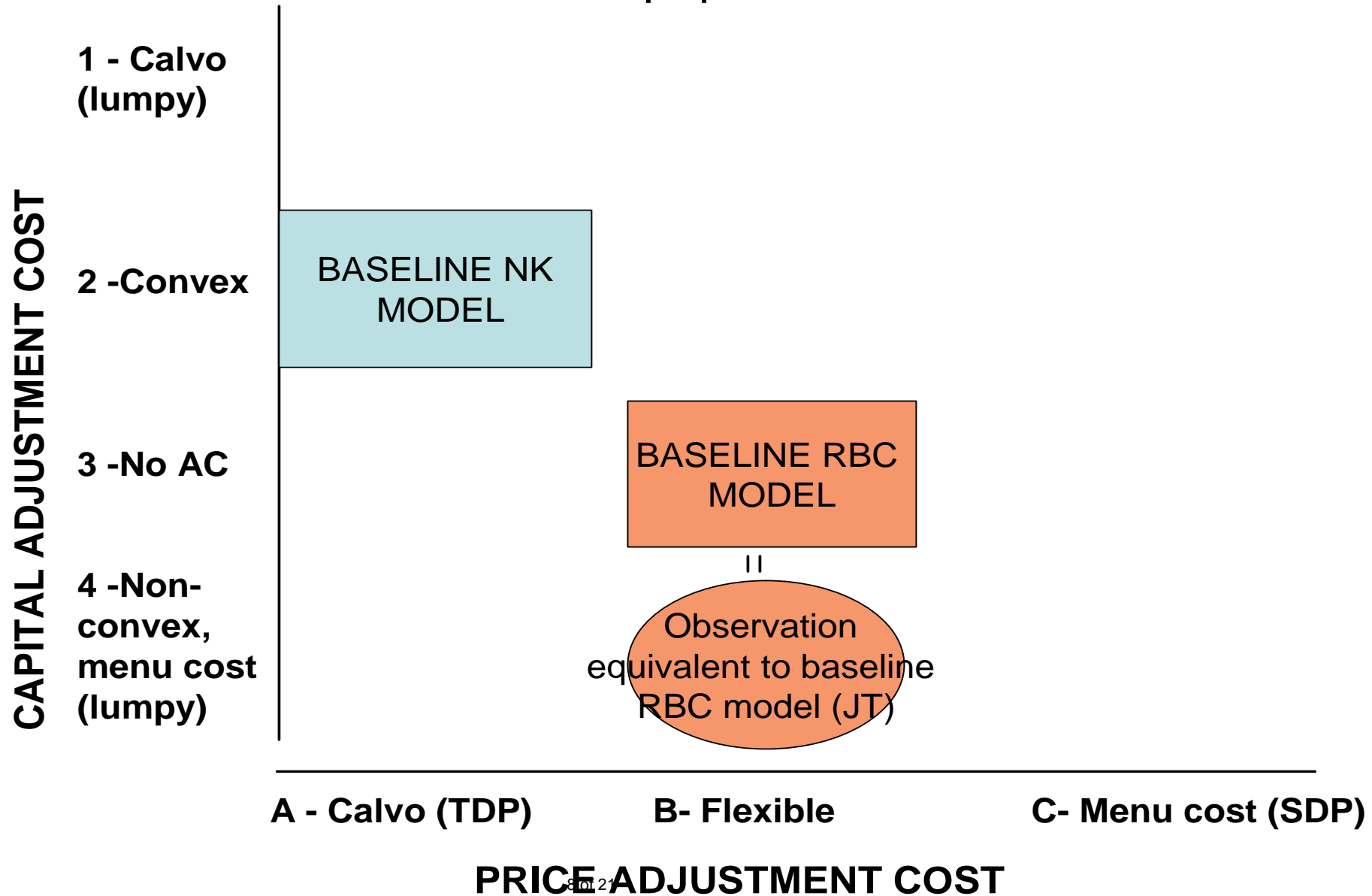
Four main points in my discussion

1. How this paper fits in the literature.

2. Intuition for the key findings.

3. What do the data say?

4. How should this paper be sold (back to the findings)?

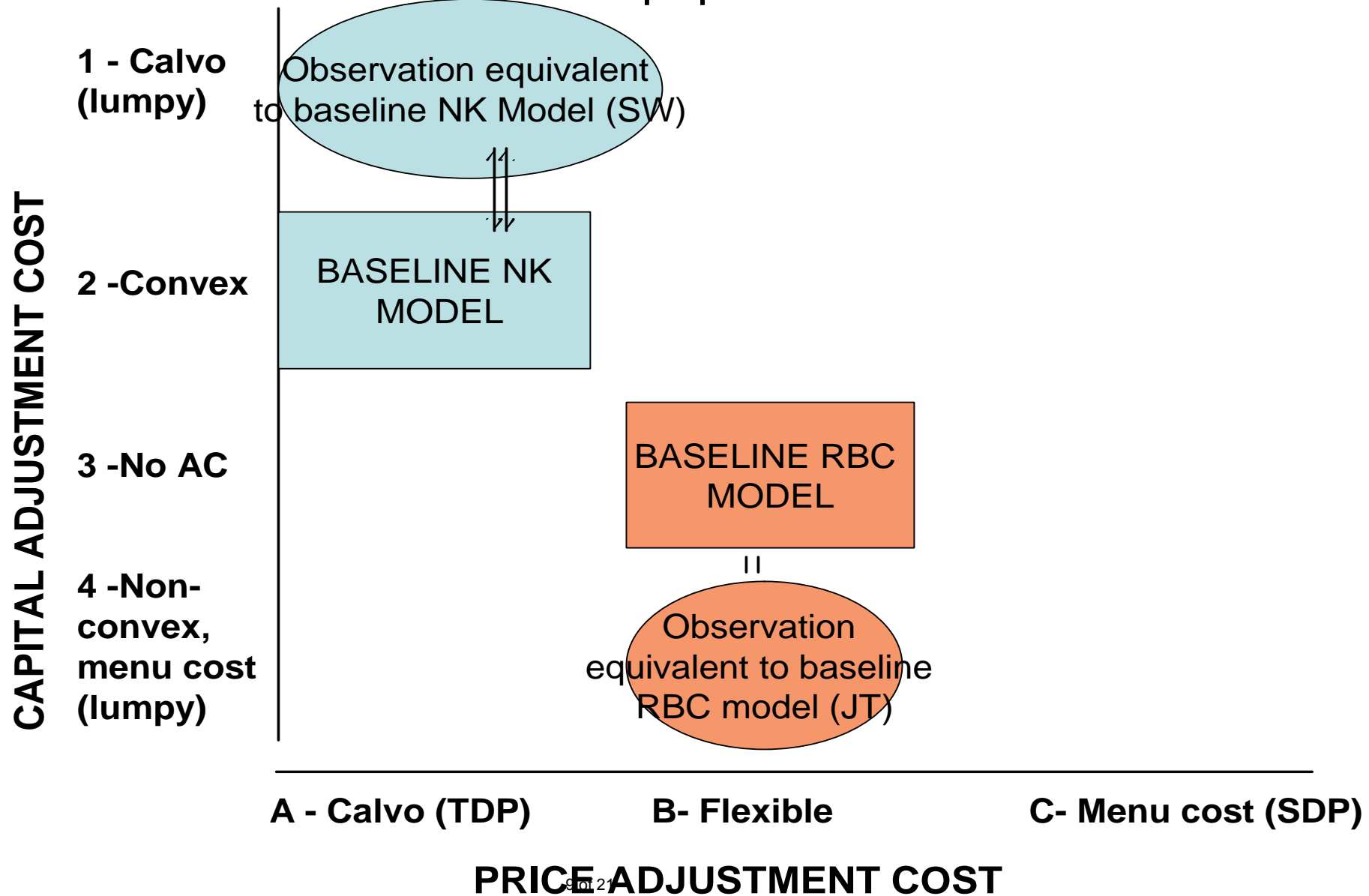1 – How this paper fits in the literature

1 – How this paper fits in the literature

CAPITAL ADJUSTMENT COST (vertical axis)

- 1 - Calvo (lumpy)
- 2 - Convex
- 3 - No AC
- 4 - Non-convex, menu cost (lumpy)

PRICE ADJUSTMENT COST (horizontal axis)

- A - Calvo (TDP)
- B - Flexible
- C - Menu cost (SDP)

BASELINE NK MODEL

BASELINE RBC MODEL

=

Observation equivalent to baseline RBC model (JT)

1 – How this paper fits in the literature

CAPITAL ADJUSTMENT COST

1 - Calvo (lumpy)

Observation equivalent to baseline NK Model (SW)

2 -Convex

BASELINE NK MODEL

3 -No AC

BASELINE RBC MODEL

4 -Non-convex, menu cost (lumpy)

Observation equivalent to baseline RBC model (JT)

A - Calvo (TDP)   **B- Flexible**   **C- Menu cost (SDP)**

PRICE ADJUSTMENT COST

1 – How this paper fits in the literature

CAPITAL ADJUSTMENT COST

1 - Calvo (lumpy)

Observation equivalent to baseline NK Model (SW)

2 -Convex

BASELINE NK MODEL

3 -No AC

BASELINE RBC MODEL

Quantitatively similar to frictionless model (GL)

4 -Non-convex, menu cost (lumpy)

Observation equivalent to baseline RBC model (JT)

A - Calvo (TDP)　　　**B- Flexible**　　　**C- Menu cost (SDP)**

PRICE ADJUSTMENT COST

1 – How this paper fits in the literature

CAPITAL ADJUSTMENT COST

1 - Calvo (lumpy)

Observation equivalent to baseline NK Model (SW)

2 -Convex

BASELINE NK MODEL

3 -No AC

BASELINE RBC MODEL

Quantitatively similar to frictionless model (GL)

4 -Non-convex, menu cost (lumpy)

Observation equivalent to baseline RBC model (JT)

JOHNSTON 2007

A - Calvo (TDP)   **B- Flexible**   **C- Menu cost (SDP)**

PRICE ADJUSTMENT COST

1 – How this paper fits in the literature

CAPITAL ADJUSTMENT COST

1 - Calvo (lumpy)

Observation equivalent to baseline NK Model (SW)

2 -Convex

BASELINE NK MODEL

JOHNSTON REFERENCE MODEL

3 -No AC

BASELINE RBC MODEL

Quantitatively similar to frictionless model (GL)

4 -Non-convex, menu cost (lumpy)

Observation equivalent to baseline RBC model (JT)

JOHNSTON 2007

A - Calvo (TDP)   **B- Flexible**   **C- Menu cost (SDP)**

PRICE ADJUSTMENT COST

1 – How this paper fits in the literature

1 – How this paper fits in the literature

CAPITAL ADJUSTMENT COST

PRICE ADJUSTMENT COST

1 - Calvo (lumpy)

2 -Convex

3 -No AC

4 -Non-convex, menu cost (lumpy)

Observation equivalent to baseline NK Model (SW)
Reinforces monetary nonneutrality

BASELINE NK MODEL

BASELINE RBC MODEL

Observation equivalent to baseline RBC model (JT)

JOHNSTON REFERENCE MODEL

Quantitatively similar to frictionless model (GL)

JOHNSTON 2007 Weakens monetary nonneutrality

A - Calvo (TDP)   **B- Flexible**   **C- Menu cost (SDP)**

2 - Intuition for the findings

1. As my previous slides show, this paper fills a gap in the literature (actually two, even the reference model is somewhat new)

2. The motivation is obvious and appealing: at the firm level, both K and P are changed infrequently

3. What drives the results?

   (a) In standard menu cost SDP models, the behavior of the model is somewhat classical (very much classical for GL, perhaps less so for DKW)

   (b) The key question is: what does lumpy capital adds to this?

   LUMPY CAPITAL (TOGETHER WITH STATE DEPENDENT PRICING) REINFORCES THE CLASSICAL BEHAVIOR OF THE MODEL.

   (c) Why does lumpy investment increase incentive to adjust prices?

      i. Aggregate prices rise over time, so the firm's relative price fall

      ii. The increase in the firm's demand for labor (output) creates large increases in the MC (since there are DRS to L): when firms change their price, they do so by a large amount

iii. Michael's added twist: as capital depreciates and cannot be adjusted, this creates an even larger increase in the firm MC, and price adjustments are even larger, so the degree of monetary nonneutrality is even smaller

3 - The data and the model assumptions

1. Most of the motivation for the paper comes from the idea that capital is lumpy at the firm level

   (a) One peculiar model assumption is that firms pay cost of adjusting even to keep the existing K constant. This appears to reinforce the findings of the paper, but seems inconsistent with evidence that firms continuosly engage in small maintenance investment. Zeroes and lumps mostly appear after taking out repairs of old capital.

   (b) The same literature that finds lumpy investment also finds lumpy labor (Hamermesh and Pfann). Why can firms easily adjust labor and not capital? As the job market for economists shows, there are large fixed costs involved in adjusting L at the level of the firm...

2. From the data, we know about micro price adjustment, and about micro capital adjustment

   Are there any exploitable firm-level datasets or cross-sectoral implications that the model can be consistent with?

   E.g. Should sectors with greater lumpiness in K exhibit larger price flexibility?

3. At the macro level, the testable implications of the model are a little too limited: this paper should be something more in the micro spirit of papers like Golosov-Lucas, who have a model that is so microfounded that does not even need to be formally tested

4 - How should the paper be sold?

Many intriguing and valuable findings

Paper could improve if you write down a list of all these findings, and sort out those that are robust and original

1 (intro) **Increases the sensitivity of inflation to all shocks. (lumpy capital makes money more neutral in state-dependent models, but maybe makes it more effective in time-dependent models. Perhaps a little too technical, but otherwise a very nice result)**

2. (conclusions) Matches the dynamic cross-correlation between output and inflation ($corr\left(y_t, \pi_{t+k}\right) > 0$) better than model without these features (I would not sell this point too much, since it does not rely on lumpy capital)

3. Shifts the action from consumption to investment in response to technology shocks, from investment to consumption in response to monetary shocks. (maybe something here)

4. Model better fits firm-level evidence on joint adjustment of prices and capital (paper is silent on this, but perhaps a micro-level data paper plus the current model=HR)