Measuring inflation in the modern economy – a micro price-setting view

Aviv Nevo[1]   Arlene Wong [2]

[1]University of Pennsylvania and NBER

[2]Princeton University and NBER

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Introduction

- Trends in advanced economics:
  - Globalization
  - (Decreased?) Competition
  - Increased high FC/low MC industries
  - Growth of e-commerce and the sharing economy
  - Price setting behavior: "Big data" and new pricing models
- We have been asked to give an IO/Marketing view on why/how these might change pricing at the micro level
- What are the aggregate implications?
  - Mostly leave it for the discussion

Overview

- We organize the discussion around two areas:
- Measurement
    - Substitution bias: shopping behavior
    - New products and online shopping
    - Measuring prices online
- Conceptual issues
    - Cost pass through
    - Decreased competition
    - "New" pricing models
    - Heterogeneity
- To think through some of the issues, one needs a specific question in mind
- We will focus (somewhat) on the question of low inflation during the recent recovery

Bottom line

- Not sure we have a bottom line, but to the extent we do
  - The need for more data
  - The need for more (collaborative) research

Why is inflation low?

- Inflation has stayed persistently low post the Great Recession
- Part of what we have been asked is to give an IO/Marketing view on reasons why this might be the case
- Why do we expect inflation to rise post recession?
  - A tightening job market should lead to rising wages
  - Rising wages (higher cost more generally) should lead to rising prices
- Did wages go up?
  - Seems like maybe not
  - We will leave if to labor economists to argue
  - Could monopsony power be a reason? (Marinescu, Azar, Steinbaum and Taska, 2018)
- Additional reason: rising aggregate demand could bring the production sector closer to capacity constraints

Other reasons for low inflation

- To an IO economist it is not obvious that even if wages went up that we should see high (measured) inflation
- Measurement of inflation
- Imperfect cost pass through
- Long term secular trends that are bringing a structural change
  - Trends in concentration
  - Global trade and a more complex supply chain
  - Changes in how firms set prices
- We provide an initial exploration of some of these topics

The measurement of inflation

- Measuring inflation is notoriously difficult
- We will focus on:
  - Substitution bias: shopping behavior
  - New products and online shopping
 - Measuring prices online

Substitution bias

- "Substitution bias occurs because a fixed market basket fails to reflect the fact that consumers substitute when relative prices change" (Boskin committee report)
- Substitution bias can come in many forms:
    - products
    - outlets
    - new goods
- We focus on shopping behavior more generally
    - Substitution across stores
    - Substitution across sizes
    - The use of coupons (or other discounts)
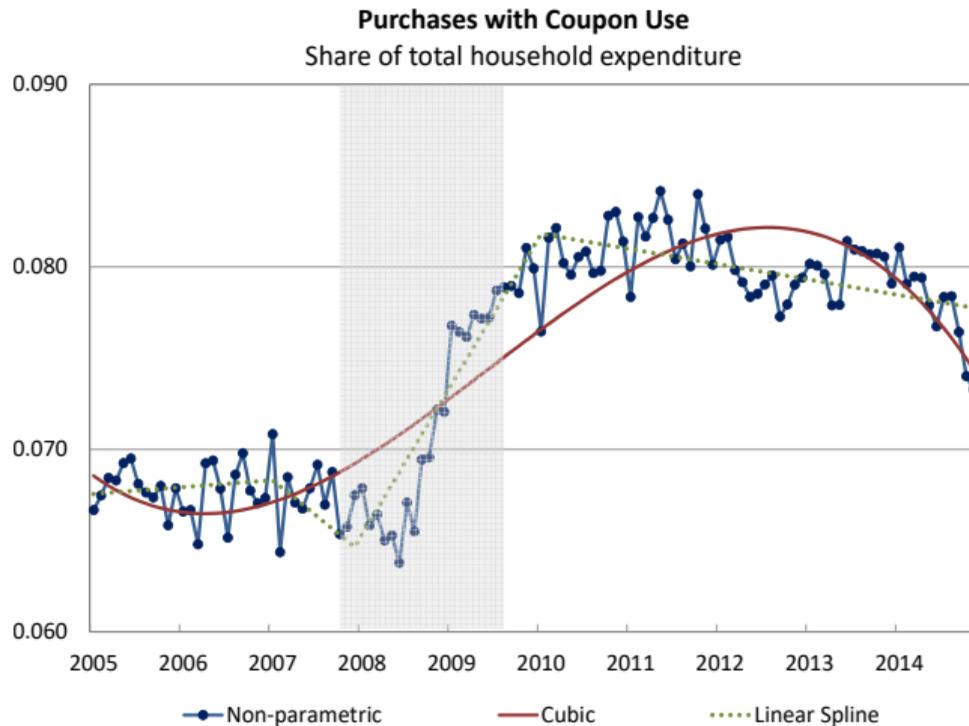   - Substitute over time (by stockpiling)

Shopping behavior

- Several papers suggest that shopping behavior changes with economic conditions
  - Aguiar and Hurst (2007); Griffith et al. (2009); McKenzie and Schargrodsky (2011); Coibion, Gorodnichenko and Hong (2012); Aguiar, Hurst and Karabarbounis (2013); Beraja, Hurst and Ospina (2015)
- Generally we believe that substitution bias leads to an underestimate of inflation
  - Nevo and Wong (forthcoming) imply increased shopping behavior, which could lead to an overestimate of inflation during the recession
  - In principle inflation could be underestimated during the recovery if behavior reverted
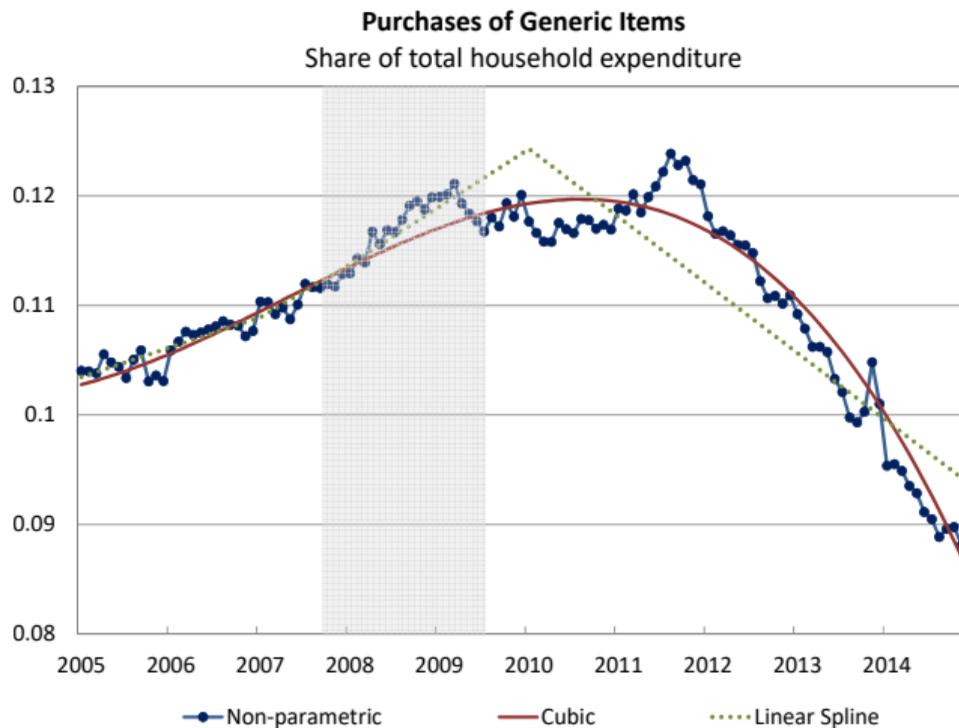
Shopping patterns and the recession: Sales

Purchases of Sale Items
Share of total household expenditure

Source: US Nielsen Homescan Data
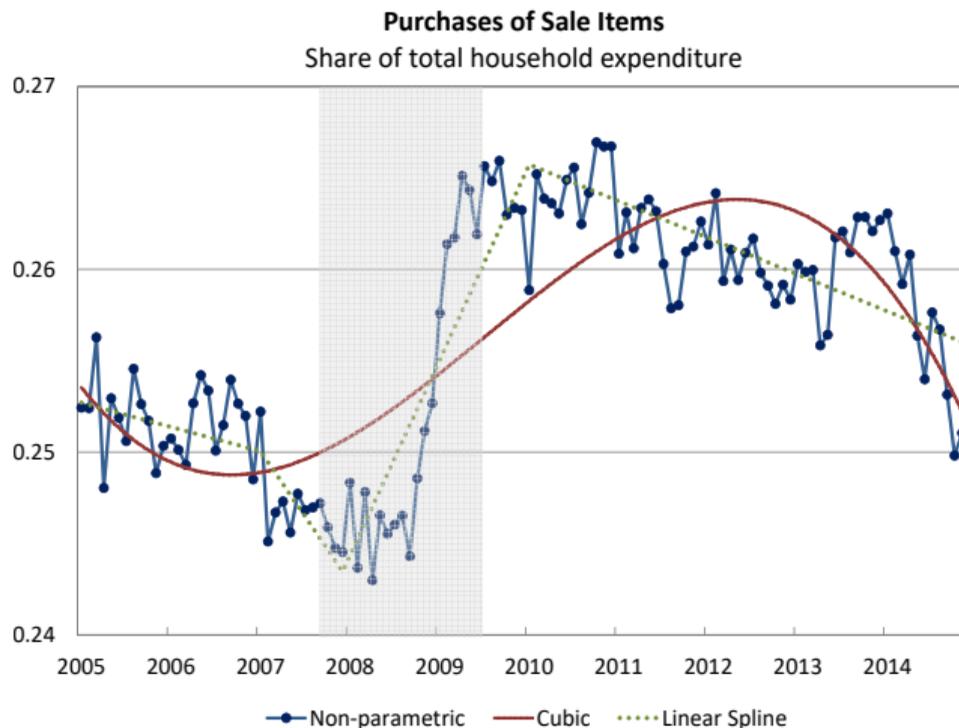
Shopping patterns and the recession: Coupons

Purchases with Coupon Use
Share of total household expenditure

Source: US Nielsen Homescan Data

Shopping patterns and the recession: Generic products

Purchases of Generic Items
Share of total household expenditure

Shopping patterns and the recession: Discount stores

Purchases made at Discount Stores
Share of total household expenditure

Source: US Nielsen Homescan Data
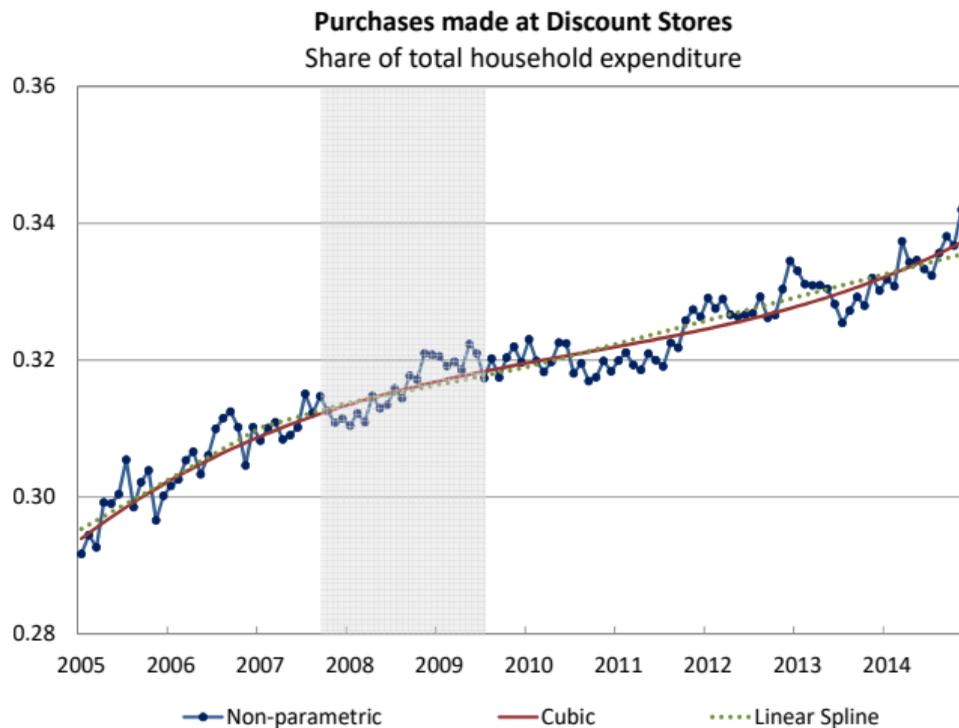
What impact did this have on inflation?

- Hard to give an exact answer
- Back of the envelope computation suggests that true inflation could be as much as 20% higher than measured inflation

Shopping behavior and the measurement of inflation

- Low inflation post recession
  - Did shopping behavior revert after the recession? yes!
  - If so, is the true inflation higher than measured? Maybe
- How about more generally?
  - Shopping behavior not new
  - But has there been a change over time?
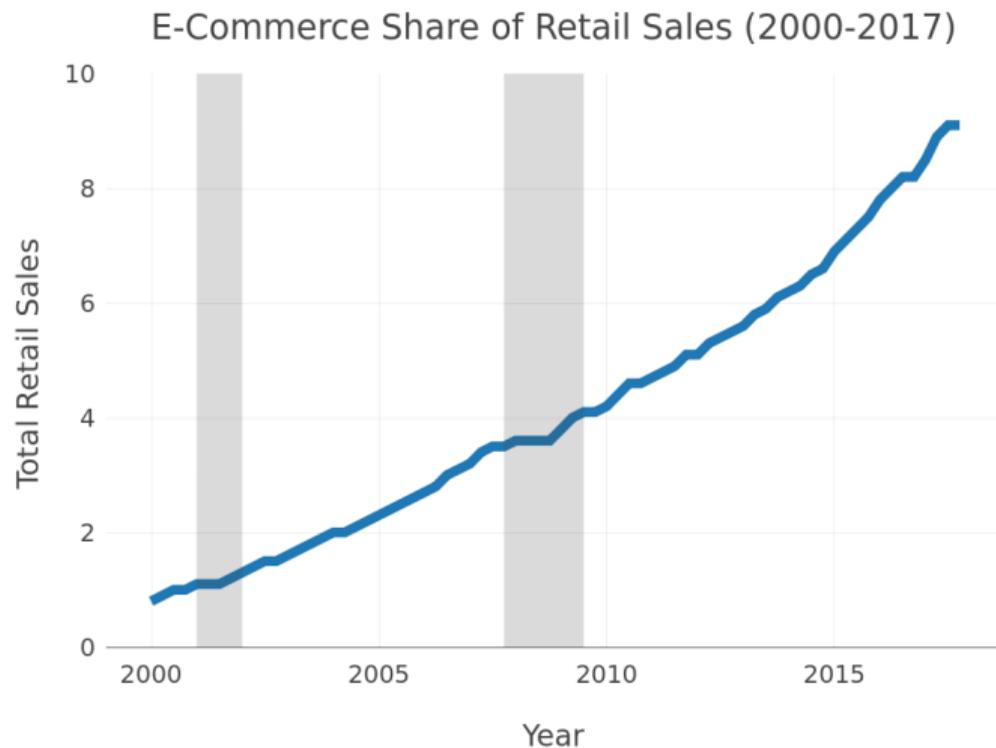 - Maybe: here are a few examples

Product variety

- Neiman and Vavra (2018) show a rise in the concentration of household spending
- So maybe less product substitution

Figure 1: Household Product (UPC) Concentration
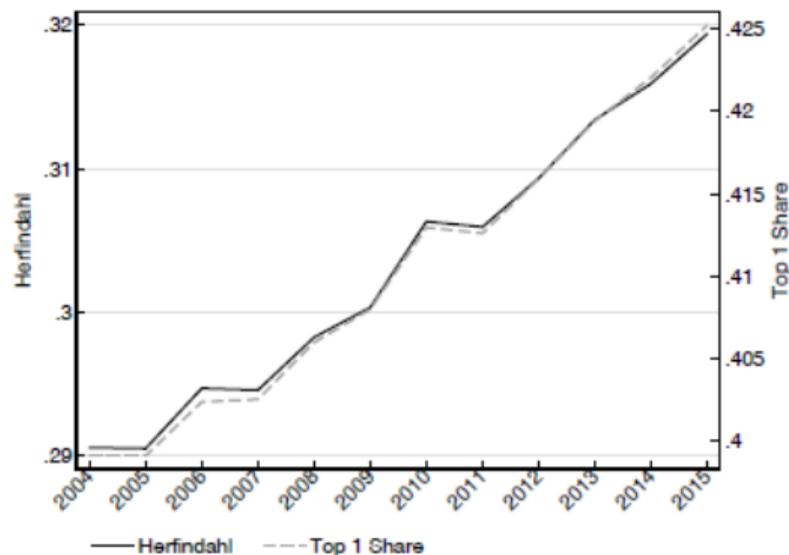
Online Shopping

- On the other hand, online shopping is increasing

E-Commerce Share of Retail Sales (2000-2017)

Measuring online economic activity

- Online shopping potentially can generate substitution bias
- But more basically there is a measurement issue
- Hasuman and Leibtag (2004) "CPI Bias from Supercenters: Does the BLS Know that Wal-Mart Exists?"
- How about Amazon? eBay? Uber? AirBnB?
    - Are online prices collected?
    - Are online prices different?
    - Easy to come up with theory that suggest they would be
    - Measurement: Goolsbee and Klenow (2018) suggest lower inflation online

Cost pass through

- It might seem intuitive that prices should go up if wages increase
- This does need to be the case
- Consider a firm f facing a (residual) demand curve $Q(p)$ setting a uniform price p to maximize

$$\max_p \Pi(p) = (p - mc)Q(p) - F$$

where mc is (constant) marginal cost; and F is fixed cost

Cost pass through

- The FOC is given by

$$p = mc - \frac{Q}{\partial Q / \partial p}$$

- It is tempting to conclude that the pass through on marginal cost is 1
- In general, this is not true
  - The semi-elasticity depends on price (for most demand curves)
  - The degree of pass through depends on the curvature of the demand curve
  - In principle, can be more or less than 1
  - "Typical" demand curves have less or near 1 (e.g. linear 0.5)
- Empirically most products pass through is less than 1

Cost pass through

- Note: imperfect pass through is profit maximizing
- It is not the case that firms are "eating the cost"
- Is this enough to explain low inflation?
- Could work together with labor market forces
- How about longer term?

Long term trends: decreased competition

- Much publicity has been given recently to the rise in market power (e.g., De Loecker and Eeckhout, 2017)
- Could this be impacting pass through?
    - Directly tied to decreasing labor share: so less impact on price even holding pass-through constant
    - Some believe that pass-through decreases with concentration, which might suggest less pass-through
    - Might be US only phenomena
- As an aside
    - What about welfare? If consumers are paying more and getting better quality are they really worse off?

More complex supply chain

- An additional long term trend is globalization and a more complex supply chain (Wei and Xie, 2018)
- Two implications
  - Less direct link between local labor and products
  - More levels of intermediates and therefore even lower(?) pass through

More complex supply chain

PPI and CPI Indexed to 100 in 1985
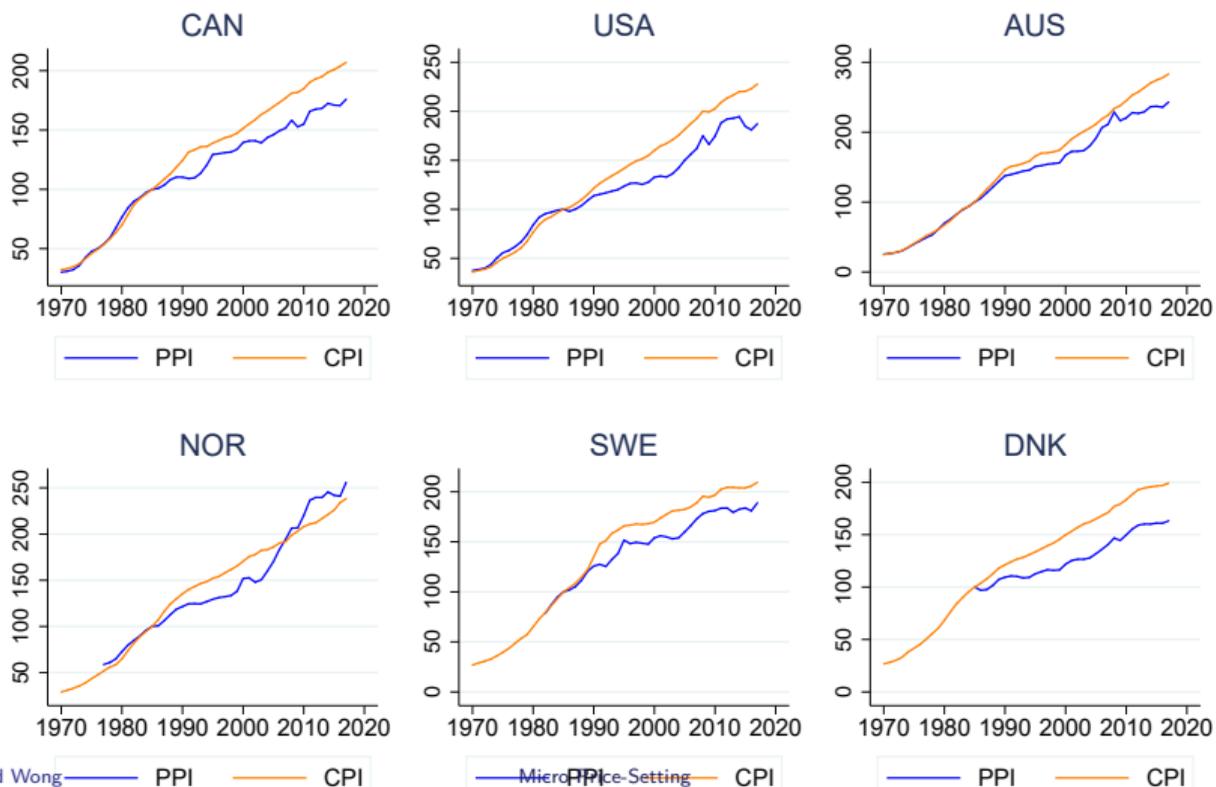
Changes in how firms set prices

- Up to now we talked about a simple linear uniform price
- However, firms are consistently coming up with new forms of pricing
- Consider (the not so new idea of) price discrimination
    - 1st degree (perfect PD): charge each consumer their WTP
    - 2nd degree (discriminate based on observable demographics): price to market, student discounts
    - 3rd degree (self sorting): coupons, temporary price reductions, product line pricing, bundling and others
- Historically limited amount of 1st and 2nd degree PD ... but with Big Data ...

Uber Starts Charging What It Thinks You're Willing to Pay

The ride-hailing giant is using data science to engineer a more sustainable business model, but it's cutting drivers out from some gains.

by **Eric Newcomer**
May 19, 2017, 10:45 AM EDT
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Uber drivers have been complaining that the gap between the fare a rider pays and what the driver receives is getting wider. After months of unsatisfying answers, Uber Technologies Inc. <https://www.bloomberg.com/quote/0084207D:US> is providing an explanation: It's charging some passengers more because it needs the extra cash.

The company detailed for the first time in an interview with Bloomberg a new pricing system that's been in testing for months in certain cities. On Friday, Uber acknowledged to drivers the discrepancy between their compensation and what riders pay. The new fare system is called "route-based pricing," and it charges customers based on what it predicts they're willing to pay. It's a break from the past, when Uber calculated fares using a combination of mileage, time and multipliers based on geographic demand.

Adam Tanner, CONTRIBUTOR
I write about the business of personal data. FULL BIO ∨
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RIC KOSTICK, THE COFOUNDER of cosmetics company 100% Pure, was clicking through his e-mail one day when a message from a San Francisco startup caught his eye.

"We've developed a machine learning algorithm that is able to predict which customers will leave your site without purchasing any of your products (with 99%-plus accuracy) and the capability to offer only this group a steeper discount than normal to entice them to purchase before leaving," said the e-mail from Freshplum. The pitch guaranteed a 5% revenue lift.

Kostick signed up. He knew some people flinch at paying $18 for an 8-ounce tube of shampoo. Perhaps occasional discounts would help. After three months using Freshplum's selective promotions, online sales increased as much as 13.52%, Kostick said.

In a traditional bazaar a seller might charge a well-dressed buyer twice as much as another based on visual clues or accents. Big data allows for a far more scientific approach to selling at different prices, depending on an individual's willingness to pay.

"Historically, first-degree price discrimination has been very difficult to implement, mostly for logistical reasons," said Harvard Business School professor John Gourville. "With advances in technology and collecting of big data, then it may be that it will become easier to do. However, very quickly you start eliciting complaints about 'fairness.'?"

Price discrimination and inflation

- What does this have to do with low inflation post-recession
- In many cases "fancier" pricing can yield lower pass through rates
- Takes measurement issues to a whole new level
- How do we measure inflation in a world where prices are individualized?
  - already today there is heterogeneity in prices levels and inflation
  - does this matter?

Concluding Comments

- Measurement
  - Substitution bias: shopping behavior
  - New products and online shopping
  - Measuring prices online
- Conceptual issues
  - Cost pass through
  - Decreased competition
  - "New" pricing models
  - Heterogeneity
- A real need for more data to measure true inflation better
  - Consistent measurement of online prices
  - A focus on what consumer pay versus what firms charge
- To understand aggregate application of modern pricing need more collaborative research

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