Impact of Treatement Effectiveness and Side Effects on Prescription Decisions: Discussion

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Summary: Motivation

- "Would patients take a more effective drug with higher risk instead of a less effective drug but safer drug?"
- The paper models prescription drug choice as a risk-return trade-off.
  - where agents are learning about the risks and returns.
  - and there exists heterogeneity across agents in such trade-offs.

Summary: Model

- The “Utility" for a given patient at a given time (subscripts suppressed)

$$U^j = f\left(e^j, s^j\right) + X^j\beta + \varepsilon^j$$

- e^j is the *perceived* "Effectiveness" of drug j
- s^j is the *perceived* (lack of) "Side effects" of drug j
- f is a CARA sub-utility function, particularly

$$f\left(e, s\right) = -\exp\left(-\left(e + s\right)\right)$$

- X^j is a vector of preference shifters (including detailing)
- ε^j is a i.i.d. extreme value (Type I) shock

Summary: Decision Rules

- Case 1: New patient
  - Choose expected utility maximizing drug

$$E\left[U^j|\Omega\right] > E\left[U^k|\Omega\right] \;\; \forall\, k \neq j$$

- Case 2: Existing patients
  - Case 2a: No switch

$$E\left[U^j|\Omega\right] > E\left[U^k|\Omega\right] - SC$$

  - Case 2b: Switched drugs where "Side effects" was cause

$$E\left[U^j|\Omega\right] < E\left[U^k|\Omega\right] - SC \text{ and } s^j < E\left[s^k|\Omega\right] \text{ and } s^j < e^j$$

  - Case 2c: Switched drugs where "Ineffectiveness" was cause

$$E\left[U^j|\Omega\right] < E\left[U^k|\Omega\right] - SC \text{ and } e^j < E\left[e^k|\Omega\right] \text{ and } e^j < s^j$$

  - Case 2d: Switched drugs where "Other causes" was cause

$$U^j < E\left[U^{j'}|\Omega\right] - SC$$

Summary: Learning and Heterogenenity

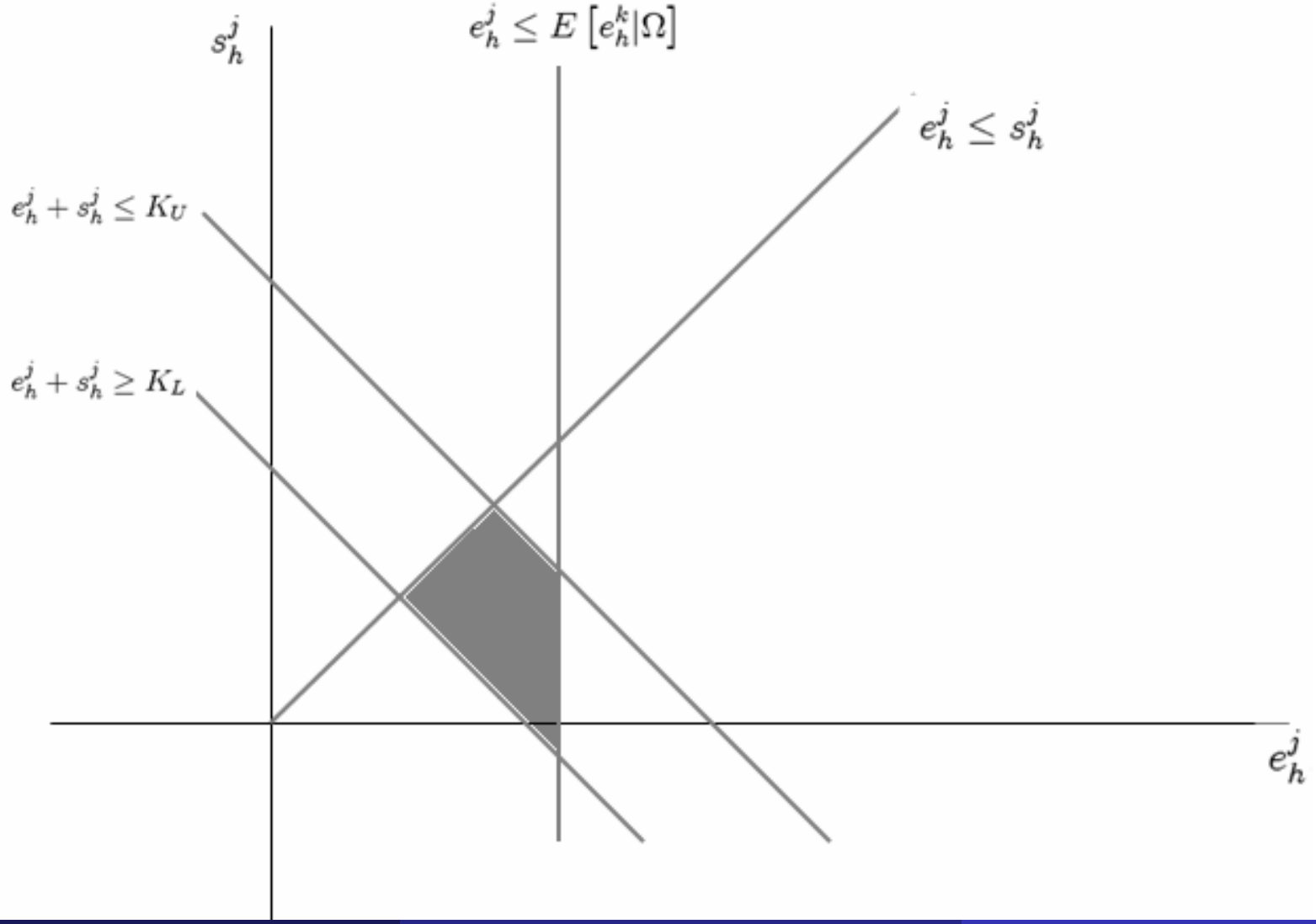
- Physicians learn in a standard Normal-Normal Bayesian framework
  - They learn about both "Effectiveness" and "Side effects"
- Physicians have (homogeneous) priors
- Informative signals come from detailing and patient feedback
  - Patient signals are correlated across drugs detailing signals are not
- Note: There is no uncertainty over patient heterogeneity only over the true "mean" drug quality.

Identification: How it works

- A main contribution of the paper is the decomposition of true mean quality into "Effectiveness" and "Side Effect" components.
- How do the authors manage this? One way to think about identification is as follows:
- If we had data, say, on e_h^j then $\overline{E} = \frac{1}{H}\sum_h e_h^j$ and other measures follow similarly.
- In other words identifying $\overline{E}$ and $\overline{S}$ (and other related parameters) depends on how well one can nail down e_h^k and s_h^k
- The authors exploit the stated switching reasons to help identification. These data impose constraints on the e_h^k and s_h^k
- Additionally, the choice data also helps (weakly) by identifying $\left(e_h^k + s_h^k\right)$
- ... as does risk aversion (by helping identify variances)
- ... and the normality assumptions (point identification.)

Identification: How it works (No risk aversion case)

- Assume $f(e_h^j, s_h^j) = \lim_{\gamma \to 0} - \exp\left(-\gamma\left(e_h^j + s_h^j\right)\right) = e_h^j + s_h^j$



Results

- Very strong results with most effects significant.
- "First mover advantage" is huge
- Cialis most "effective"and has least "side effects"
- Detailing informative about effectiveness while patient visits are more informative about side effects.
- One detailing visit (with meal!) reduces most uncertainties, but persuasive effects persist.

- Results consistent with "common wisdom" (WebMD!)
  - Viagra and Levitra take 30 mins to work and last 4-5 hours
  - Cialis works in 15 mints and can last 36 hours!

Comments & Issues

- **Sufficiency of Data**
  - Of the 13,619 visits there are only 929 (E) + 161 (S) informative switches.
  - Are there enough switches? Or is identification being achieved via functional form and parametric assumptions?
- **Model Assumptions**
  - *Risk aversion* :
    - Specification adopted implies that the CARA parameter $r = \frac{f''}{f'} = 1$
    - How might one justify this assumption? Is this nonlinearity essential?
  - *Switching Costs*
    - Can switching costs be independent of brands, of quality measures and marketing efforts in this category?
- **Heterogeneity vs. Learning**
  - There is no physician level heterogeneity (Priors are identical as are responses to marketing effects.)
  - Does this create a confound?

Concluding Remarks

- Overall a nice paper that attempts to decompose learning about multiple facets of a product.
- More generally one can think of the it as using data from *consumer exit interviews* to help deconvolve otherwise unidentified effects.
- Other applications might include
  - Wireless carrier switches
  - Bank account closures
  - Job Quits
- The paper also highlights the value of non-choice data.
  - Any individual level data on preferences (or lack thereof) helps tease out heterogeneity better.
  - Shameless promotion example: Survey data on preferences can help construct informative priors in learning models (Shin, Misra and Horsky 2007)