Directed Attention in Markets*

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The Question

1. Modern markets are inherently complex. I concentrate on two frictions:
   - **Search (External):** It takes time to physically find an offer.
   - **Attention (Internal):** It takes (cognitive) effort to evaluate it.

2. Some aspects of each offer are **immediate to process** (e.g. wages) while other **require costly effort to evaluate** (e.g. benefits or amenities).

3. I am interested in how the important variables such as:
   - Terms of trade (e.g. prices/wages).
   - Market composition (e.g. buyers per seller, workers per vacancy, etc.).
   - Welfare.

   are affected by changes in conditional match utility value in equilibrium.

Motivation

1. The use of equilibrium search models with incomplete information is growing (e.g. Guerrieri and Shimer, 2014, 2018, Delacroix and Shi, 2014, Menzio, 2007).
   - Most such search models feature signals of exogenous precision (e.g. Delacroix and Shi, 2014, Pries and Rogerson, 2005), if any.
2. The interest in *endogenous* information acquisition is on the rise (Moscarini and Smith, 2001, Sims, 2003).
3. Modeling *endogenous* information acquisition *in equilibrium* search models seems to be a natural next step in both literatures.

Contribution

1. Briggs et al. (2019) show that exogenous and endogenous information acquisition leads to completely different comparative statics for the key variables.

2. We propose a rational inattention approach which:
   - Renders a simple closed-form solution in terms of elementary functions.
   - Behaves qualitatively similar to choosing precision of normal signals[†], but is more tractable.

3. The natural next step is to embed this framework in a standard *directed* search model.
   - This showcases the effect of freely observable wages (or prices) on endogenous information acquisition.

[†]See Ambuehl, Ockenfels and Stewart (2018) for a comparison of normal signals and rational inattention.

Learning in Search and Matching Models

	Random Search	**Directed Search**
Complete Information	McCall (1970)	Shimer (1996), Moen (1997), Acemoglu and Shimer (1999).
Exogenous Learning	Burdett and Vishwanath (1988), Conlon et al. (2018).	Menzio (2007), Delacroix and Shi (2014), Guerrieri and Shimer (2014).
Endogenous Learning	**Briggs et al. (2019)**	**This Paper**

Implications of Endogenous Learning

1. Improving low quality jobs leads to:
   - Lower job acceptance levels.
   - Fewer good jobs being offered by employers.
   - Decreased welfare of workers.
2. Decreasing unemployment benefits has the same effects.
3. Both shocks have the opposite effects when learning is exogenous (Briggs et al. 2019).

Model Overview
Abstract from Search, Focus on Attention.

1. Firms privately choose offer quality, $\omega \in \{G, B\}$
2. Each matched worker chooses how precise a costly signal to obtain:
   - He pins down the conditional acceptance probabilities, P_G and P_B.
   - The Shannon function maps any $(P_G, P_B) \in [0, 1] \times [0.1]$ into a utility cost of effort.
3. Matched workers decide whether to accept their job offers.
4. Payoffs are realized.

Payoffs
An Example

1. Let the worker's payoffs be:
   - $\ln z_G$ if he accepts a good job.
   - $\ln z_B$ if he accepts a bad job.
   - **0** if he rejects.

2. Let the firm's payoffs be:
   - **1** if the worker accepts a good job.
   - **2** if the worker accepts a bad job.
   - **0** if the worker rejects.

3. To rule out uninteresting cases, assume:

$$\ln z_G > 0 > \ln z_B \Leftrightarrow$$
$$z_G > 1 > z_B > 0$$

The Model at a Glance
The Three Key Components

1. Let μ be the probability that a firm posts a good job. For the worker's cognitive problem to be nontrivial, I need $\mu \in (0, 1)$. Thus I require:

$$P_G = 2P_B \tag{1}$$

i.e. that the firm is indifferent between the two job types.

2. The worker solves:

$$\max_{P_G, P_B} \quad \mu P_G \cdot \ln z_G + (1 - \mu)P_B \cdot \ln z_B - S\left(\mu, P_G, P_B\right) \tag{2}$$

in which S is the Shannon attention cost function.

3. Bayes' Rule holds:

$$P = \mu P_G + (1 - \mu)P_B \tag{3}$$

Solution

1. Consistently with Matejka and McKay (2015), the first order conditions of the worker's problem imply:

$$P_\omega = \frac{z_\omega P}{z_\omega P + (1 - P)} \text{ for } \omega \in \{G, B\} \tag{4}$$

2. Combining (4) with $P_G = 2P_B$ renders a linear equation for P^*:

$$\frac{z_G P}{z_G P + (1 - P)} = \frac{2z_B P}{z_B P + (1 - P)}$$

3. Substituting the P^* back into (4) yields (P_G^*, P_B^*).
4. Then, the Bayes' Rule (3) renders μ^*.
5. Jointly, (μ^*, P_G^*, P_B^*) fully characterize the equilibrium.
6. A dynamic extension of the model is solved using the same idea.

Comparative Statics

1. Note that $P_G = 2P_B$ implies:

$$\frac{z_G}{z_G P + (1 - P)} = \frac{2z_B}{z_B P + (1 - P)}$$

   in which:
   - The LHS the firm's expected payoff from posting a good job (divided by P)
   - The RHS analogously represents a bad job.

2. As the unconditional acceptance probability P increases, bad jobs become relatively more lucrative for firms than the good ones.
   - The LHS decreases and the RHS increases.

3. When workers' payoff from some job type increases, the job becomes more likely to get accepted and thus more lucrative for firms to post.
   - The LHS increases in z_H and the RHS in z_L.

Comparative Statics
Improvement in Bad Jobs

Acceptance Probability when Bad Jobs Improve
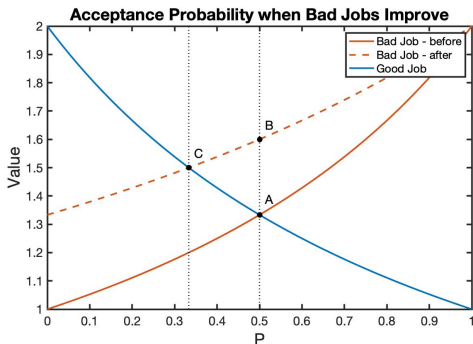
1. Suppose z_B increases. Bad jobs become better for firms to post.
2. For both job types to be posted, bad jobs have to become worse for firms and the good ones - better.
3. That happens for a lower P.

The Role of Wages
When Search is Directed

1. **Wages direct search** i.e. they determine how many workers see the offer.
2. **Wages affect beliefs** about the non-wage characteristics of a job.
   - The more a firm pays, the stronger its incentive to give its workers extra responsibilities and to save on benefits or amenities.
3. **Wages direct workers' attention** to upside or downside risks.
   - When the wage is high, it is most important not to reject a good job.
   - When the wage is low, it is most important not to accept a bad job.

Results on Wages
In Equilibrium

1. Very high wages discourage workers from applying, so employers don't post them.
2. Adding a free exogenous ex-post signal (as in Jovanovic, 1979) may reduce welfare if ex-ante learning is sufficiently easy.

Concluding Remarks

1. An equilibrium model of a labor market with search and attention frictions.

2. Favorable shocks or policies that discourage paying attention can leave rationally inattentive workers worse off.

3. May be relevant: many businesses help people find suitable offerings.

4. Next steps:
   - Applying the model to retail and financial markets.
   - Bringing it to the data.