

# Costly Job Search with Inattentive Workers

Siting (Estee) Lu

Job Market Candidate  
Department of Economics, University of Edinburgh

EEA Congress 2025


# Core Question

How does limited attention shape workers' job search behaviours?  
And what does this mean for labour market efficiency?

# Motivation

- Traditional models assume workers process all job information *perfectly* and have *no prior information* about wages.
  - Even with free online resources, workers could still suffer from limited attention and may not learn **true** wages (e.g. [Matějka and McKay, 2015, Woodford, 2020]).
  - They could have past application experiences or initial bias towards certain firm (e.g. [Erev et. al., 2010, Sáenz-Royo et al., 2022]).
- Empirical evidence shows job search is *imperfect* and *narrowly focused* [Belot et. al, 2019], which are not fully captured by current theory [Wu, 2020].
- We need a generalized model to fully characterize how imperfect cognition leads to workers' imperfect search behaviour and shapes labour market outcomes.

# This Paper

- Contributes to works on [rational inattention](#) and [directed search](#). 
- Proposes a Generalized Partially Directed Search (GPDS) model that builds on existing model [Wu, 2020], but **additionally** account for:
  - 1 Variations in default strategies
  - 2 Possibility of equilibrium multiplicity
  - 3 Heterogeneous attention costs
- Demonstrates viability of explaining macro patterns of information-based mismatch via micro-level decision-making constraints, suggesting attention-focused policy solutions.

# Main Results

- Narrow Search Patterns:
  - 1 *Biased Search*. High attention costs + biased default strategy = targeted search. Mismatch may be inherited from workers' initial bias.
  - 2 *Multiple Equilibria*. Even without bias, inattentive workers could apply narrowly and more to different firms.
- Efficiency and Monopsony Power:
  - 1 *Greater Efficiency*. Equilibria with workers applying with higher probability to different firms are more efficient than them applying symmetrically.
  - 2 *Weaker Monopsony Power*. Firms may also extract less wage markdown in the former.

## Key Insight

When workers are inattentive, one-to-one matching isn't guaranteed even in small set-up where coordination maybe possible, but some equilibria can be more efficient than others.

# Generalized Partially Directed Search (GPDS) Model: Set-up & Timing

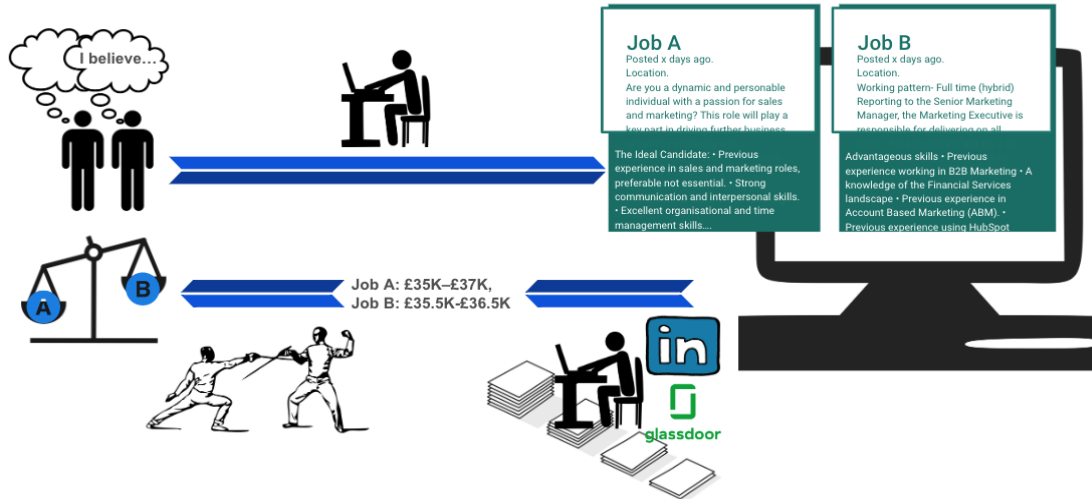
$2 \times 2$  framework: workers,  $i = 1, 2$ ; firms,  $j = 1, 2$ . Each firm offers one vacancy.

- 1 Productivity of firm 1 and 2,  $\mathbf{z} = (z_1, z_2)$ , are exogenously determined. They observe  $\mathbf{z}$  and set wages,  $\mathbf{w} = (w_1, w_2)$ .
- 2 Workers **cannot** observe wages or productivities directly. They can pay an attention cost to learn about the wages at a precision level of their choice, they then select an application strategy.
- 3 Matching and hiring take place. If matched, workers receive  $w_j$ , and firms receive  $z_j - w_j$ . If not matched, both receive outside option of 0. If both workers apply to the same firm, one of them will be randomly selected.

Both parties understand the game, the information availability and the optimization problem.

# Workers' Search Process

*Attention Costs as Foraging and Processing Efforts.*



# Worker $i$ 's Search Problem

Following [Wu, 2020, Ravid, 2020, Steiner et al., 2017],

$$\max_{q_1^i(\mathbf{w}), q_2^i(\mathbf{w}) \in [0,1]} \underbrace{q_1^i(\mathbf{w})(1 - q_1^{-i}(\mathbf{w}) + \frac{q_1^{-i}(\mathbf{w})}{2})}_{\text{Job Finding Prob.}} \underbrace{w_1}_{\text{Payoff}} + q_2^i(\mathbf{w})(1 - q_2^{-i}(\mathbf{w}) + \frac{q_2^{-i}(\mathbf{w})}{2})w_2 - \underbrace{\lambda_i(q_1^i(\mathbf{w}) \log \frac{q_1^i(\mathbf{w})}{p_1^i} + q_2^i \log \frac{q_2^i(\mathbf{w})}{p_2^i})}_{\text{Attention Cost}} \quad (1)$$

- **Entropy control cost formulation.** Workers are anchored on a default strategy, and they face attention costs when deviating from this default.
- Precision is **implicit**  $\Rightarrow$  combines information acquisition & search decision.
- Equilibrium Concept: **subgame perfect equilibrium.**

# Attention Costs

$$\hat{c}_i = \underbrace{\lambda_i}_{\text{Cog Cost}} \left( q_1^i(\mathbf{w}) \log \frac{q_1^i(\mathbf{w})}{\underbrace{p_1^i}_{\text{Default}}} + q_2^i(\mathbf{w}) \log \frac{q_2^i(\mathbf{w})}{p_2^i} \right).$$

- **Cognitive Costs.** ( $\lambda_i$ )
  - Unit cost of processing information.
  - Degree of precision in learning about wages/cognitive ability.
  - $\lambda_i > 0$ : Even if wages are perfectly observable, there is always noise in cognitive representation of wages [Woodford, 2020, Heng et al., 2020].
- **Default Strategies.** ( $p_j^i$ )
  - Default probability of applying to firm  $j$ .
  - Exogenous and assumed to be bounded,  $p_j^i \in (0, 1)$ .
- **Rational & Behavioural Components.** Workers undergo a constrained optimization problem with attention costs, and they could enter the market with an initial bias.

# Firm $j$ 's Maximization Problem

- Firm  $j$  maximizes its profit by posting a wage,  $w_j$ , given  $w_{-j}$ ,

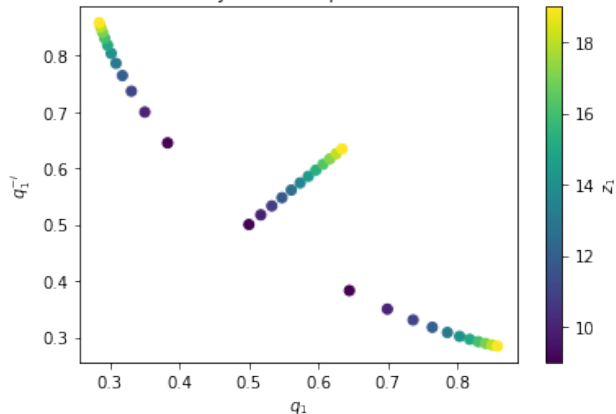
$$w_j = \operatorname{argmax}_{w_j} \underbrace{[1 - (1 - q_j^i)(1 - q_j^{-i})]}_{\text{Prob. of meeting a worker}} (z_j - w_j), \quad \text{s.t. } z_j \geq w_j \geq 0 \quad (2)$$

- Firms do not discriminate between workers.
- They receive a payoff of  $z_j - w_j$  as long as they are matched with one worker.

# Example: Workers' Equilibrium Strategies

**Recall for Workers.** They apply **simultaneously**, their choice is perturbed best response to wages offered and other worker's application strategy.

Solutions to the System of Equations (SSPE & ASPE)



- Workers either apply to firms randomly (**Symmetric Subgame Perfect Equilibrium (SSPE)**) OR more exclusively to different firms (**Asymmetric Subgame Perfect Equilibrium (ASPE)**).
- Main takeaway:** Multiple equilibria possible.

Figure shows **multiple** solutions for workers' equilibrium choice probability of firm 1. **Colour Spectrum** indicates transition as  $z_1$  increases against  $z_2$ . ( $\lambda = 1$ ,  $z_1 \in [8, 20]$ ,  $z_2 = 8$ ,  $p_1 = p_1^{-i} = \frac{1}{2}$ )

# Modification to Original PDS Model: Default Strategy

[Wu, 2020] assumes workers have **non-informative priors** about wage distribution. I relax this – workers may have **weakly informative priors** from logical reasoning, intuition, experiences, perceived goodwill. [Dietrich & List, 2013, Sáenz-Royo et al., 2022, Erev et. al., 2010] Their default choice of each option may be **non-random**.

## Proposition (Belief Distortion on Symmetric Equilibrium Application Probability)

For homogeneous workers applying symmetrically, **biased defaults lead to biased search**.

$$\frac{dq^*}{dp} = \frac{\frac{1}{p(1-p)}}{\frac{1}{q^*(1-q^*)} + \frac{\frac{1}{2}(w_1^* + w_2^*) + (2q^* - 2q^{*2} + 1)(z_1 + z_2)}{\lambda} + \left[ \frac{2-q^*}{(1-q^*)^2} + \frac{1+q^*}{q^{*2}} \right]} > 0 \quad (3)$$

As cognitive costs ( $\lambda \uparrow$ ) increase, workers become fully reliant on their defaults. Formally:

$$\lim_{\lambda \rightarrow \infty} q^* = p \text{ and } \lim_{\lambda \rightarrow \infty} \frac{dq^*}{dp} = 1.$$

# Modification to Original PDS Model: Considering Equilibrium Multiplicity

[Wu, 2020] assumes workers only behave **symmetrically**. I relax this – workers may also adopt **asymmetric** strategies.

## Lemma (1. Existence of Asymmetric Subgame Equilibrium)

*For a given set of  $(w_1, w_2)$ , the necessary condition for asymmetric subgame equilibria (ASE) to exist is sufficiently small  $\lambda$  relative to expected payoff, which is determined by the wage levels (for  $w_1 = w_2 = w$ ), or wage differences (for  $w_1 \neq w_2$ , where  $2w_1 > w_2 > \frac{w_1}{2}$  is fulfilled).*

- Higher likelihood of one-to-one matching when workers have **low cognitive costs** and firms have **high productivities**.
- Despite ex-ante symmetry, there is potential for ex-post asymmetry.

# Example: Firms' Equilibrium Wage Setting

**Recall for Firms.** They are competing for workers, setting wages simultaneously before workers' turn given their expectation of workers' reaction.



- Firms can exploit information asymmetry when workers are imprecise in learning about wages (i.e.  $z_j > w_j$ )
- Main takeaway:** ASPE may have higher wages than SSPE.

**Counter-intuitive?**

Figure shows wages in SSPE and ASPE as  $z_1$  increases against  $z_2$ . ( $\lambda = 1$ ,  $p_1 = p_1^{-i} = \frac{1}{2}$ ,  $z_1 \in [8, 20]$ ,  $z_2 = 8$ )

# When and why are wages higher in ASPE than SSPE?

Consider a *classic* case of **homogeneous firms** ( $z_1 = z_2 = z$ ) & **homogeneous workers** ( $p = 0.5$ ):

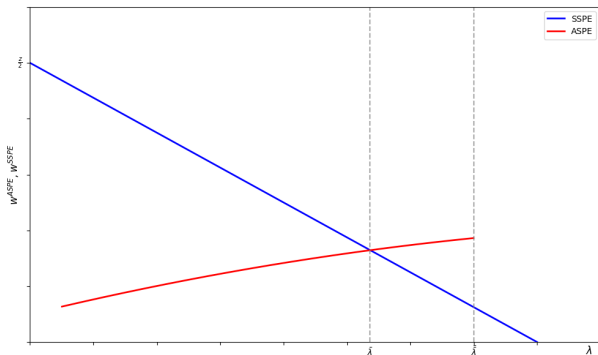
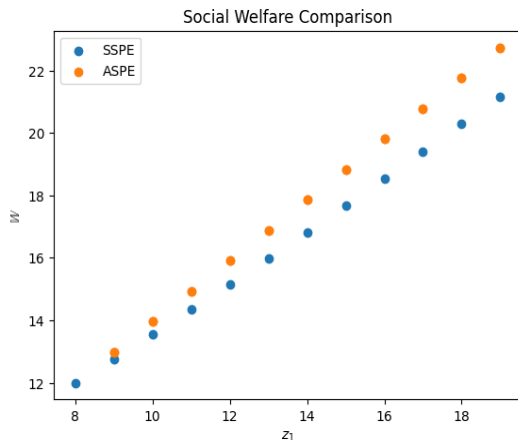


Figure shows SSPE and ASPE for some  $z$  and  $\lambda$ s

- Conditional on ASPE existence,  $w^{ASPE} \geq w^{SSPE}$  for **some level of inattentiveness**.
- **Intuition.** Higher risk of failing to attract the “targeted” worker and left worker-less.
- More aggressive initial wage setting may result in higher overall wages.

# Example: Social Welfare Comparison



- **Main takeaway:** Social welfare,  $W$ , is higher under ASPE than SSPE (Proposition).
- Welfare increases more for ASPE than SSPE as firm heterogeneity increases.
- Benefit of filling both vacancies with higher probability  $>$  more productive firm gets higher application rate from both.

Figure shows social welfare under ASPE and SSPE as  $z_1$  increases against  $z_2$ . ( $\lambda = 1$ ,  $p_1 = p_1^{-i} = \frac{1}{2}$ ,  $z_1 \in [8, 20]$ ,  $z_2 = 8$ )

## Additional Analysis: Constrained Social Planner Problem

### Definition. (Constrained social planner problem)

Constrained social planner problem maximizes social welfare by solving for **one** optimal application strategy for both workers, where  $\hat{q}$  is the socially optimal probability to firm 1.

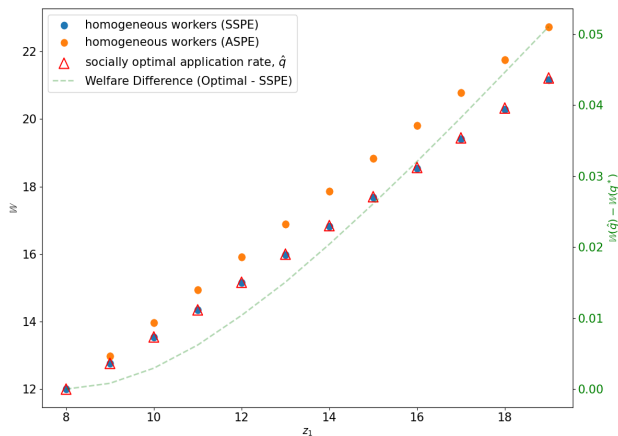
$$\max_{q \in [0,1]} (1 - (1 - q)^2)z_1 + (1 - q^2)z_2 - \underbrace{\lambda_1 \left( q \log \frac{q}{p_1} + (1 - q) \log \left( \frac{1 - q}{1 - p_1} \right) \right)}_{\text{Worker 1 Attention Cost}} - \underbrace{\lambda_2 \left( q \log \frac{q}{p_1^{-i}} + (1 - q) \log \left( \frac{1 - q}{1 - p_1^{-i}} \right) \right)}_{\text{Worker 2 Attention Cost}} \quad (4)$$

For homogeneous workers, given  $z_1$ ,  $z_2$  and  $\lambda$ ,  $\hat{q}$  can be the **efficiency benchmark** to evaluate equilibrium strategies.

$$\hat{q} = \frac{1}{1 + \frac{1-p}{p} \exp \left( - \left( \frac{(1-\hat{q})z_1 - \hat{q}z_2}{\lambda} \right) \right)} \quad (5)$$

**Main takeaway:** SSPE tends to be inefficient, relative to the efficiency benchmark.

# Example: Homogeneous Workers ( $q_1^*$ vs. $q^*$ vs. $\hat{q}$ )



- $W(q_1^*) > W(\hat{q}) \geq W(q^*)$
- Overlooking ASPE could be detrimental to welfare analysis.
- Market may be perceived as more inefficient than it actually is.

Figure shows social welfare under ASPE, SSPE and socially optimal strategy as  $z_1$  increases against  $z_2$ . ( $\lambda = 1$ ,  $p_1 = p_1^{-i} = \frac{1}{2}$ ,  $z_1 \in [8, 20]$ ,  $z_2 = 8$ )

# Main Findings For Heterogeneous Workers

- 1 **Heterogeneity in Default Strategies.** ( $p_j^i \neq p_j^{-i}$ )
  - Only asymmetric equilibria prevail.
  - One-to-one matching more likely if workers are strongly biased to different firms.
- 2 **Heterogeneity in Cognitive Costs.** ( $\lambda_i \neq \lambda_{-i}$ )
  - In SSPE,  $\lambda$  of the less attentive worker has a larger negative impact on the equilibrium wages.
  - In ASPE, when wage differential is small, more attentive worker is more likely to avoid overcrowding.
- 3 **Equilibrium Multiplicity.** More equilibria may arise with heterogeneity. Social welfare would depend on **equilibrium selection**.
- 4 **Efficiency Benchmark.** Socially optimal  $\hat{q}$  is influenced by worker heterogeneity. **Less attentive and more biased worker has a stronger impact.**

# Concluding Remarks

- Provides theoretical foundation for how limited attention and biases in default strategy create frictions in labour market.
- **Policy Implications:**
  - ① Strengthen pay transparency laws (i.e.  $\lambda_i$ ).
  - ② Align workers' default strategy with market conditions (i.e.  $p_j^i$ ).
  - ③ Consider equilibrium selection measures depending on policy objectives.
- **Model Applicability:**
  - ① Connects to observations that workers often search narrowly and with bias [Belot et. al, 2019].
  - ② **!!** Effective in conveying that one-to-one matching is not guaranteed even with 2 workers and 2 firms. It could fit the idea of consideration set in multi-agent environment. [Hauser & Wernerfelt, 1990], [Caplin et al., 2019]

# Thank you!

Thank you for listening!  
Full draft of my JMP:



Comments welcome!





## Siting (Estee) Lu





**Research Works:** Behavioural economics;  
Game theory; Adaptive learning; Searching and  
matching; Large language model (LLMs)  
applications in economic games

- ✉ [s.lu@ed.ac.uk](mailto:s.lu@ed.ac.uk)
- ✕ [@EsteeLu](#)
- [BLUESKY @EsteeLu](#)
- [in Siting \(Estée\) Lu](#)
- [🌐 sitingesteelu.com](https://sitingesteelu.com)



-  Belot, Michele and Kircher, Philipp and Muller, Paul (2019)  
Providing advice to jobseekers at low cost: An experimental study on online advice  
*The review of economic studies* 86(4), 1411–1447.
-  Wu, Liangjie (2024)  
Partially Directed Search in the Labor Market  
*Journal of Economic Theory* 105858
-  Matějka, Filip and McKay, Alisdair (2015)  
Rational inattention to discrete choices: A new foundation for the multinomial logit model  
*American Economic Review* 105(1), 272–298
-  Woodford, Michael (2020)  
Modeling imprecision in perception, valuation, and choice  
*Annual Review of Economics* 12(1), 579–601
-  Erev, Ido and Ert, Eyal and Roth, Alvin E and Haruvy, Ernan and Herzog, Stefan M and Hau, Robin and Hertwig, Ralph and Stewart, Terrence and West, Robert and Lebiere, Christian (2010)  
A choice prediction competition: Choices from experience and from description  
*Journal of Behavioral Decision Making* 23(1), 15–47

-  Dietrich, Franz and List, Christian (2013)  
Reasons for (prior) belief in Bayesian epistemology  
*Springer*
-  Sáenz-Royo, Carlos and Chiclana, Francisco and Herrera-Viedma, Enrique (2020)  
Functional Representation of the Intentional Bounded Rationality of Decision-Makers: A Laboratory to Study the Decisions a Priori  
*Mathematics* 10(5), 739.
-  Ravid, Doron (2020)  
Ultimatum bargaining with rational inattention  
*American Economic Review* 110(9), 2948–2963.
-  Heng, Joseph A and Woodford, Michael and Polania, Rafael (2020)  
Efficient sampling and noisy decisions  
*Elife* (9), e54962

-  Steiner, Jakub and Stewart, Colin and Matějka, Filip (2017)  
Rational inattention dynamics: Inertia and delay in decision-making  
*Econometrica* 85(2), 521–553.
-  Hauser, J. R. and Wernerfelt, B. (1990)  
An evaluation cost model of consideration sets  
*Journal of consumer research*, 16(4), 393–408
-  Caplin, A., Dean, M., and Leahy, J. (2019)  
Rational inattention, optimal consideration sets, and stochastic choice  
*The Review of Economic Studies* 86(3), 1061–1094
-  Gronau, Reuben. (1971)  
Information and frictional unemployment.  
*The American Economic Review* 61(3), 290–301.

-  Cheremukhin, Anton and Restrepo-Echavarria, Paulina and Tutino, Antonella (2020)  
Targeted search in matching markets  
*Journal of Economic Theory* 185, 104956.
-  Acharya, Sushant and Wee, Shu Lin (2020)  
Rational inattention in hiring decisions  
*American Economic Journal: Macroeconomics* 12(1), 1–40.
-  Habermalz, Steffen (2014)  
Rational inattention and employer learning  
*Oxford Economic Papers* 66(2), 605–626.
-  Briggs, Joseph and Caplin, Andrew and Martin, Daniel and Tonetti, Christopher and Stanford, GSB (2017)  
Due Diligence: Job Search with Rationally Inattentive Workers  
*NYU working paper*
-  Giezek, Mateusz (2019)  
Rational Inattention in Search  
*New York University*

## Appendix: Traditional Search Costs vs. Attention Costs

- Difference from traditional search costs [Gronau, 1971]:
  - ① **Partial Information.** Agency fees did not capture granularity in information gathering driven by individual decisions.
  - ② **Internal Information Availability.** Acquiring previously inaccessible data indicates better external information availability, but does not imply improved information environment in the cognitive system.
  - ③ **Time  $\neq$  Precision.** More time invested may encompass learning more precise wages, but not all time spent searching automatically signify higher precision.
- Attention cost captures the complexities of information acquisition and processing, in which workers are constrained by their own ability and willingness to learn.
- Incorporates ex-ante bias, drawing from neuro and behavioural literature.

[Back to Main](#)