

Lecture 1: Job Search (Part I)

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1. <https://sites.google.com/view/franck-malherbet/home/teaching/labor-economics>

Why study job search theory ?

- A central question in labor and macroeconomics is what determines the level of employment and unemployment in the economy ?
- Usual (textbook) answer is given by the **neoclassical framework** where labor supply and labor demand determine (voluntary) unemployment.
- The neoclassical framework rests on strong hypotheses :
 - perfect information
 - people are either **employed** or **out of the labor force** (non participant), *i.e.*, there is no room for unemployment !

Why study job search theory?

- This is obviously at odds with the data where (long term) unemployment is pervasive.
- Hence, the neoclassical framework is neither realistic nor a useful framework to study unemployment (and related issues).
- The alternative view is to focus on **labor market frictions**.
- **Job search theory** consists in studying the **behavior** of workers who have **imperfect information** about :
 - jobs
 - wages

Why study job search theory ?

- In the next lectures, we will be *mostly* interested by the supply side, *i.e.* the **job search behavior of workers**.
- Then later on, we will **gradually** consider both the supply and the demand sides of the labor market :
 - equilibrium search models
 - equilibrium search and matching models
 - search friction and firm dynamics (*if time permits*)

- Why should we abstract from the **neoclassical framework**?

1. Need to abstract from neoclassical labour supply theory :

- Perfect information : each agent is assumed to know everything about all wage offers, thus, no need to search for a job.
- In reality, jobs cannot be found instantaneously, *i.e.* the labor market is not a spot market.

2. No role for unemployment in the standard labour supply-labour demand framework :

- Leisure or (home production) is the only alternative to waged work.
- Difficult to make a difference between being unemployed (searching for jobs) and non-participant (not *actively* searching).

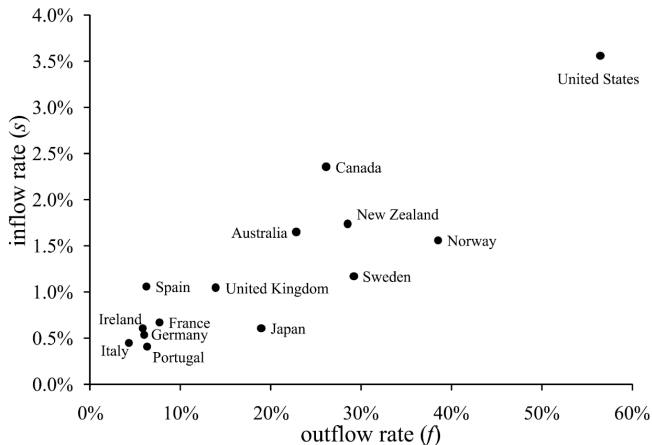
3. Searching for a job takes time :

- **Frictions** are an important explanation to the existence of unemployment.
- Unemployment is not (or not always) leisure.
- Searching longer may also lead to better labor market prospect.

4. Empirical motivation : in the data, unemployment duration is far from being negligible :

- about 14-15 months in France before the 2008 crisis,
- about 14 weeks in the US before the 2008 crisis.
- Unemployment and unemployment duration vary a lot :
 - across countries,
 - across individuals depending on age, education, labour market histories.

Inflows and Outflows from unemployment



Source : Elsby, Hobjin and Sahin (2013). Average monthly inflow rate into and exit rate out of unemployment in OECD countries over the period [1968-2009].

Long term unemployment in OECD countries

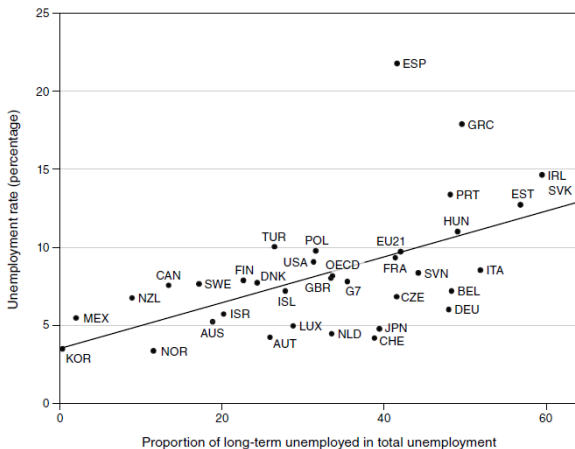


FIGURE 9.8

The relationship between the unemployment rate and the proportion of long-term unemployed in the OECD countries in 2011.

Source: OECD Labor Force Statistics database.

- Many unemployed workers devote considerable effort in looking for a job without getting satisfactory offers.
- The **job search theory** consists in studying the behavior of an individual who has imperfect information about jobs and wages.
- The idea to analyse markets under imperfect information was initially due to Stigler (1961, 1962).
- The modern theory of job search arose in the 1970s with McCall (1970)² and Mortensen (1970).³

2. McCall (1970), Economics of information and job search, Quarterly Journal of Economics.

3. Mortensen (1970), Job search, the duration of unemployment, and the Phillips curve, American Economic Review.

- 1 Introduction
- 2 What do job seekers do ?
- 3 Basic job search model
 - Model
 - Comparative statics
- 4 The choice of non-participation, job seeking, or employment
- 5 Application
- 6 Wrap up
- 7 Appendix

What do job-seekers do ? Average minutes per day by activity and employment status in the US

	Employed	Unemployed
Sleep	496	555
Personal care and eating	110	97
Home production, shopping, care of others	158	254
Leisure, travel, sport and socializing	320	442
Work	325	10
Job search	1	32

Table 1 – Average minutes per day by activity and employment status in the US in 2003-2006

Source : Krueger and Mueller (2012), *The lot of the unemployed : a time use perspective*, Journal of the European Economic Association.

How job seekers spend their time

- The unemployed spend on average 32 minutes per day looking for work, whereas the wage-earners spend up to 325 minutes at work.
- This difference may flow from :
 - Differences in observed characteristics (e.g. age, education, gender),
 - Differences in unobserved characteristics between the employed and the unemployed (e.g. psychological state),
 - Differences in **behavior** conditional on characteristics.

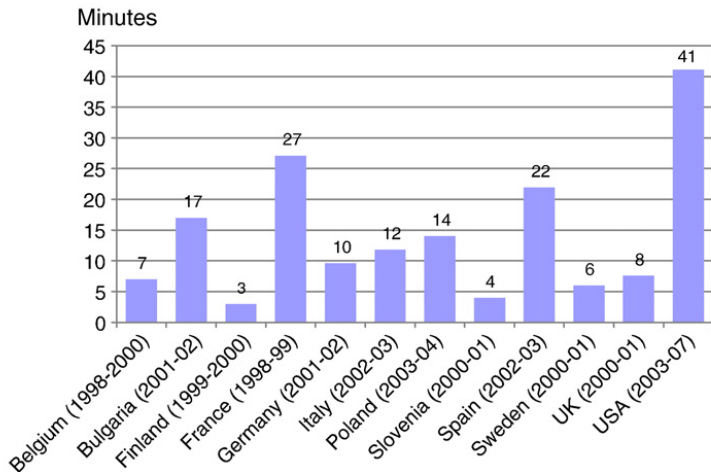
What do job-seekers do ? How job seekers spend their time

- Table 1 presents comparative information about how wage earners and unemployed persons in the United States spend their time.
- Two effects may influence the difference in the amount of time spent searching for work of an unemployed person and the time wage earners spend at work :
 - *Substitution effect* : an hour of work implies a wage whereas an hour of job search gives you a chance of obtaining a job interview or (at best) of being hired.
 - *Income effect* : the income of an unemployed person is less than that of a wage earner.

What do job-seekers do? How job seekers spend their time

- The unemployed devote more time to :
 - Domestic production, shopping, and taking care of other members of their household, than wage-earners do.
 - Sleep, leisure, sports, and socializing also bulk large in the use of their time.
- Table 1 suggests that the first **substitution effect** is largely dominant.
- The preceding data apply to the US, but Krueger and Mueller (2010, 2012) have reported analogous observations for Canada and European countries.

What do job-seekers do? How job seekers spend their time



Notes : See Krueger and Mueller (2008a) for details about the underlying time use data.

Fig. 1. Average number of minutes devoted to job search per day on weekdays by unemployed workers in various countries.

What do job-seekers do ? How job seekers spend their time

- These results are confirmed by recent studies with a time devoted to search somewhat higher than in the ATUS (see Krueger and Mueller, 2010).
- For instance :⁴
 - DellaVigna, Heining, Schmieder and Trenkle (2022),
 - Faberman, Mueller, Sahin, and Topa (2022),

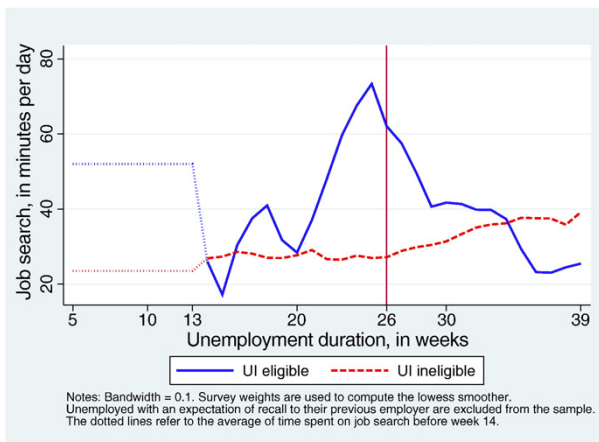
find that the average time spent searching is **about 80 minutes** in Germany and in the U.S. respectively.

4. See e.g. :

DellaVigna et al (2022), Evidence on Job Search Models from a Survey of Unemployed Workers in Germany, *Quarterly Journal of Economics*.

Faberman et al. (2022), Job Search Behavior among the Employed and Non-Employed, *Econometrica*.

What do job-seekers do? How economic incentives affect the time to job search



Source : Krueger and Mueller (2010)

What do job-seekers do ? How economic incentives affect the time to job search

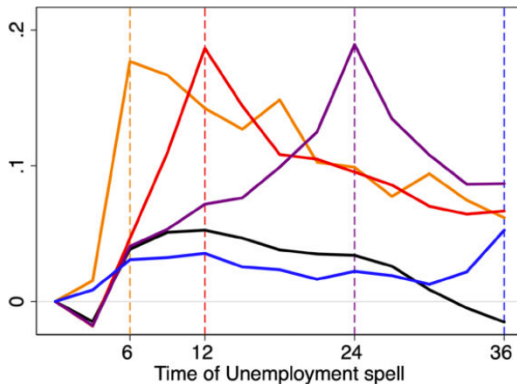
- The previous graphic reports the amount of time spent searching by persons eligible for unemployment insurance as a function of the duration of their spell of unemployment in the United States over the period 2003-2006.
- It strongly suggests that **financial support during unemployment influences the amount of time devoted to job search**, and that beneficiaries intensify their job search as their period of eligibility approaches in order to avoid the drop in income if they have not found work at that time.

What do job-seekers do? How economic incentives affect the time to job search

- Krueger and Mueller (2010) find that **more generous unemployment benefits diminish the amount of time devoted to job search.**
- They also find that job seekers who likely have less access to financial resources tend to respond more to unemployment insurance benefits than do those with greater financial wherewithal.
- Similar evidence are found for other countries. For example, Marinescu and Skandalis (2021) found convincing evidence of a peak in search effort at benefit exhaustion in France.⁵

5. Marinescu and Skandalis (2021), Unemployment insurance and job search behavior, *Quarterly Journal of Economics*.

What do job-seekers do? How economic incentives affect the time to job search



Search effort over the unemployment spell, for unemployed workers eligible for 6 (yellow), 12 (red), 24 (violet), and 36 (blue) months of UI and those ineligible (black) for UI.

Source : Marinescu and Skandalis (2021)

What do job-seekers do ? How economic incentives affect the time to job search

- Unemployed workers react to **aggregate condition** as labor demand affects the returns of job search.
- The theoretical and empirical literature provides ambiguous evidence on the **cyclicalities of job search** :⁶
 - Pro-cyclical : DeLoach and Kurt (2013)
 - Counter-cyclical : Mukoyama et al. (2018)
- The COVID-19 crisis provides a natural experiment to understand how job seekers react to adverse macro shock.

► Graphic

6. see for instance :

DeLoach and Kurt (2013), "Discouraging Workers : Estimating the Impacts of Macroeconomic Shocks on the Search Intensity of the Unemployed", Journal of Labor Research.

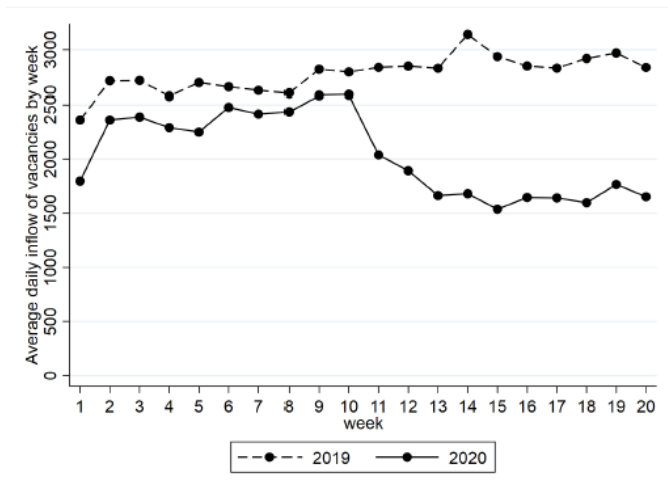
Mukoyama, Patterson and Sahin (2018), "Job Search Behavior over the Business Cycle", American Economic Journal : Macroeconomics.

What do job-seekers do? How economic incentives affect the time to job search

- Hensvik et al. (2020) study Job Search during the COVID-19 Crisis.⁷
- Measures the job-search responses to the pandemic using realtime data on vacancy postings and ad views on Sweden's largest online board (*platsanken.se*).
- Following a large negative demand shock, job seekers respond to the shock by :
 - 1 searching less intensively
 - 2 redirecting their search towards less severely hit occupations

7. Hensvik, Le Barbanchon and Rathelot, Job Search During the COVID-19 Crisis, CEPR Discussion paper 14748.

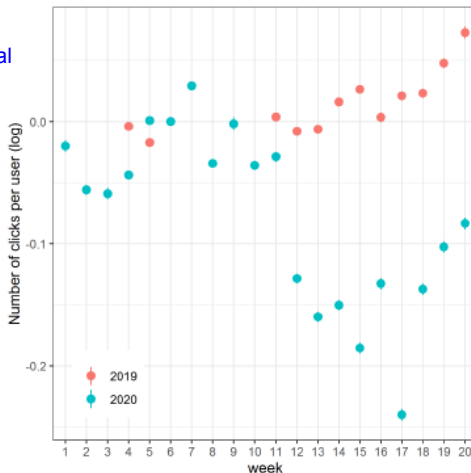
What do job-seekers do ? How economic incentives affect the time to job search



Source : Platsbanken between Jan 1st and May 17th in 2019 and 2020. Hensvik et al. (2020).

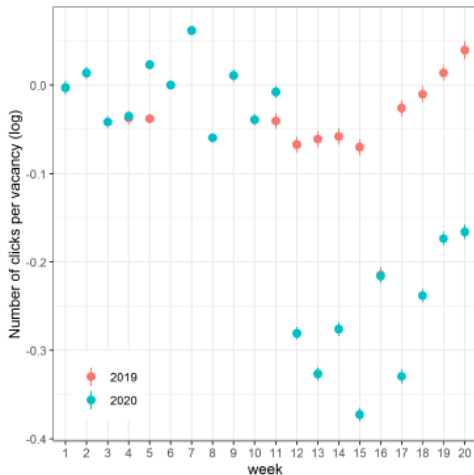
What do job-seekers do? How economic incentives affect the time to job search

Evidence in favour
of Job Search procyclical
in this case



Source : Clicks on Platsbanken between Jan 1st and May 17th in 2019 and 2020. Hensvik et al. (2020).

What do job-seekers do ? How economic incentives affect the time to job search



Source : Clicks on Platsbanken between Jan 1st and May 17th in 2019 and 2020. Hensvik et al. (2020).

The Model

- Job search theory arises initially out of a *basic model describing the behavior of a person looking for work* in a situation of **imperfect information**.
- The basic job search model rests on the following assumptions :
 - They are not allowed to select the intensity of their search,
 - They cannot look for jobs once they are employed,
 - They receive a single job offer at a time,
 - They cannot recall job offers once rejected (sequential search).⁸

⁸. See e.g. Burdett and Judd (1983) for a non-sequential job search model in a different context. Burdett and Judd (1983), Equilibrium price dispersion, *Econometrica*.

Main assumptions

- *Continuous time* model with risk neutral workers, i.e. utility is linear in the income w :

$$u(w) = w$$

- Workers are rationale and discount future at rate $r > 0$.
- All job-seekers are entitled to a flat unemployment income, z , with no time limit, no taxes and no budget constraint in the model.
- There is a single type of job, jobs differ in the wage offered solely.
- A job offer is a wage for a *full-time job* (working time not modeled).

Main assumptions (cont'd)

- The environment is stationary.⁹
- Exogenous, stationary and known-by-all distribution of wage offers, with cdf $H(\cdot)$ and pdf $h(\cdot)$.
- The optimal strategy of a person looking for work consists simply of choosing a *reservation wage* that represents the lowest remuneration he will accept.
- A job offer comes down to the proposal of a *constant real wage*, w , which the worker will receive on each date as long as he remains with the firm that makes the offer.

9. See e.g. van den Berg (1990) for a non-stationary model and next lecture.

- Let us denote by :
 - V_e , the expected utility of an **employed** worker,
 - V_u , the expected utility of an **unemployed** worker.
- Let dt be a small interval of time.
- Let us denote by :
 - q , the arrival rate of job loss,
 - w , instantaneous income (utility) from working.
- The discounted expected utility of an employed worker writes :

$$V_e(t) = \frac{1}{1 + rdt} [w dt + (1 - qdt)V_e(t + dt) + qdtV_u(t + dt)]$$

- Multiplying by $1 + rdt$ and dividing by dt yields

$$rV_e(t) = w + q[V_u(t + dt) - V_e(t + dt)] + \frac{V_e(t + dt) - V_e(t)}{dt}$$

- Letting $dt \rightarrow 0$

$$rV_e(t) = w + q[V_u(t) - V_e(t)] + \lim_{dt \rightarrow 0} \frac{V_e(t + dt) - V_e(t)}{dt}$$

- One gets :

$$rV_e(t) = w + \underbrace{q[V_u(t) - V_e(t)]}_{\text{exp. change in income upon job loss}} + \underbrace{\dot{V}_e(t)}_{\text{change in the value of the job}}$$

where $\dot{V}_e(t)$ is the derivative wrt time.

- In a *stationary environment* $\dot{V}_e = 0$, and we can drop time indices, such that :

$$rV_e = w + q[V_u - V_e] \quad (1)$$

- It is also useful to make the link between w and V_e resulting from (1) explicit, so that

$$\underbrace{V_e(w) - V_u}_{\text{exp. gain from accepting a job at wage } w} = \frac{w - rV_u}{r + q} \quad (2)$$

- The difference between the expected utility of an employee and that of an unemployed person :
 - expands with the wage accepted,
 - shrinks with the discounted expected utility of the unemployed person.

- The **optimal job-search strategy** is then as follows :
 - 1 If the job-seeker receives no offer at date t , she continues looking. This behavior results from the stationarity of intertemporal utility V_u .
 - 2 If the job-seeker receives a wage offer w :
 - she accepts if $V_e(w) \geq V_u$,
 - she continues looking if $V_e(w) < V_u$.
- Since $V_e(w)$ is an increasing linear function of the wage offered, the search strategy amounts to the adoption of a "**stopping rule**" that dictates accepting wage w if and only if it is superior to a certain threshold-value - the **reservation wage**.
- The *reservation wage* x satisfies :

$$x = rV_u = rV_e(x)$$

- Let us denote by :
 - λ , arrival rate of job offers,
 - z , instantaneous income (utility) from looking for a job.
- The **expected utility from receiving a job offer**, V_λ writes :

$$V_\lambda = \int_0^x V_u h(w) dw + \int_x^\infty V_e(w) h(w) dw$$

$$V_\lambda = \int_0^x V_u dH(w) + \int_x^\infty V_e(w) dH(w)$$

- The **discounted expected utility of a job seeker**, V_u , writes :

$$V_u = \frac{1}{1 + rdt} [zdt + \lambda dt V_\lambda + (1 - \lambda dt) V_u]$$

where

$$z = \underbrace{b}_{\text{ui benefits+home prod+value of leisure}} - \underbrace{c}_{\text{cost of job search}}$$

- Rearranging V_u , we obtain :

$$rV_u = z + \lambda (V_\lambda - V_u)$$

- Plugging V_λ into the equation above yields :

$$rV_u = z + \lambda \left(\int_0^x V_u dH(w) + \int_x^\infty V_e(w) dH(w) - V_u \right)$$

- Remarking that $V_u = \int_0^x V_u dH(w) + \int_x^\infty V_u dH(w)$ yields :

$$rV_u = z + \lambda \int_x^\infty (V_e(w) - V_u) dH(w)$$

- Making use of (2), the discounted expected utility of a job seeker rewrites :

$$rV_u = z + \lambda \int_x^\infty \left(\frac{w - rV_u}{r + q} \right) dH(w)$$

- The **reservation wage** x rewrites as :

$$x = z + \frac{\lambda}{r + q} \int_x^{+\infty} (w - x) dH(w) \quad (3)$$

- Equation (3) shows that the reservation wage is equal to :
 - the net income from the job search,
 - the **discounted expected value** of what the job search can yield above the reservation wage.

- The values of some other important variables derives from the reservation wage :
 - the out of unemployment hazard rate (exit rate),
 - the average duration of unemployment.
- The **exit rate from unemployment** writes :

$$\underbrace{\lambda}_{\text{job offer arrival rate}} \times \underbrace{[1 - H(x)]}_{\text{prob. that the job offer is at least equal to } x}$$

and is decreasing in the reservation wage.

- The **average duration of unemployment** writes :¹⁰

$$\frac{1}{\lambda [1 - H(x)]}$$

and is increasing in the reservation wage.

10. Recall that if a random variable follows a Poisson process of parameter f , then the mathematical expectation of this variable is $\frac{1}{f}$. See Handout #1 for a more formal statement.

- Population :

$$U + L = N$$

- The **law of motion** of the number of unemployed workers satisfies :

$$\frac{dU}{dt} = \underbrace{qL}_{\text{inflows into unemployment}} - \underbrace{\lambda [1 - H(x)] U}_{\text{outflows from unemployment}}$$

- In a stationary state where $\frac{dU}{dt} = 0$, we get :

$$u = \frac{q}{q + \lambda [1 - H(x)]}$$

- The **unemployment rate** is increasing in the reservation wage.

- The reservation wage depends on 4 variables : z, λ, r, q
- To study how those variables affect the reservation wage x , apply the **Implicit function theorem** to the equation above.
- Let us define

$$\Phi(x, z, \lambda, r, q) = x - z - \frac{\lambda}{r + q} \int_x^\infty (w - x) dH(w) \quad (4)$$

- The **Implicit function theorem** implies that for any parameter $p \in \{z, \lambda, r, q\}$

$$\frac{dx}{dp} = - \frac{\Phi'_p}{\Phi'_x}$$

where Φ'_x is then computed applying **Leibnitz's rule**.¹¹

11. **Leibnitz's rule** : Let $F(x) = \int_{a(x)}^{b(x)} f(x, y) dy$, then the derivative wrt x verifies

$$F'(x) = f(x, b(x))b'(x) - f(x, a(x))a'(x) + \int_{a(x)}^{b(x)} \frac{\partial f}{\partial x}(x, y) dy.$$

- Applying the rule to (4) yields :

$$\Phi'_x = 1 + \frac{\lambda(1 - H(x))}{r + q} > 0$$

while

$$\Phi'_z = -1$$

- so that

$$\frac{dx}{dz} = -\frac{\Phi'_z}{\Phi'_x} > 0$$

- Interpretation :**

- An increase in the income (net of search cost) of a job seeker $z = b - c$ increases her reservation wage.
- Following an increase in z , she will become more demanding :
 - the proportion of acceptable job offers $1 - H(x)$ decreases,
 - the exit rate from unemployment $\lambda [1 - H(x)]$ decreases,
 - the average unemployment duration $\frac{1}{\lambda[1-H(x)]}$ increases.

- Similar calculations (**left as homework**) establish that

$$\frac{dx}{dr} = -\frac{\Phi'_r}{\Phi'_x} < 0; \frac{dx}{dq} = -\frac{\Phi'_q}{\Phi'_x} < 0; \frac{dx}{d\lambda} = -\frac{\Phi'_\lambda}{\Phi'_x} > 0;$$

- **Interpretation :**

1. $\frac{dx}{dr} = -\frac{\Phi'_r}{\Phi'_x} < 0$: A rise in r represents a job seeker who places less value on the future than another. This person has a lower reservation wage and on average, shorter unemployment duration.
2. $\frac{dx}{dq} = -\frac{\Phi'_q}{\Phi'_x} < 0$: An increase in q makes workers less demanding because :
 - they expect better opportunities in the future after accepting a short-duration job,
 - the gap between the utility of an employee and a job seeker shrinks.

This person has a lower reservation wage and on average, shorter unemployment duration.

3. $\frac{dx}{d\lambda} = -\frac{\Phi'_\lambda}{\Phi'_x} > 0$: An increase in the arrival rate of wage offers λ has an ambiguous effect on the amount of time devoted to looking for a job :
- Job seekers revise their reservation wage upward, which decrease the probability of accepting an offer $[1 - H(x)]$,
 - Since the average duration of unemployment is $1/\lambda [1 - H(x)]$, the consequence of an increase in λ and a decrease in $[1 - H(x)]$ is ambiguous.

Remark : If the elasticity of the reservation wage to the job offers arrival rate is low, then the average duration of unemployment should decrease.

What do empirical studies tell us?

- In practice, difficult to identify λ due to lack of accurate data.
- Empirical studies seems to conclude that the *direct* effect (through λ) dominates the *indirect* effect (through x).¹²

12. See e.g. van den Berg (1994), The effects of changes of the job offer arrival rate on the duration of unemployment, *Journal of Labor Economics*.

The participation margin

- The (neoclassical) theory of labor supply comprises only participant or non-participant cases.
- The neoclassical theory defines the reservation wage as the market wage that makes an individual indifferent between participating or not.
- The theory of job search assumes that workers who participate in the labor market are faced with a choice between unemployment and employment.
- Participating to the labour market and accepting a wage offer are two separate decisions.

- Job search theory defines the reservation wage, x , as the wage that makes the worker indifferent between working or searching for a job.
- The reservation wage x depends on the overall characteristics of the labor market.
- Let us denote by $\Omega \equiv \Omega(z, q, \lambda, r)$ those characteristics such that :

$$x \equiv x(\Omega)$$

- Then based on the comparison between V_e and V_u , it follows that :

$$\begin{aligned} \text{if } w &> x(\Omega) \Rightarrow \text{employee (work)} \\ \text{else if } w &\leq x(\Omega) \Rightarrow \text{unemployed (search)} \end{aligned}$$

- Let R_I denote the constant income of a non-participant.
- Her lifetime earnings as a non-participant, V_I , satisfies :

$$V_I = \int_0^{+\infty} e^{-rt} R_I dt = \frac{R_I}{r}$$

- The choice between participation and non participation is based on the comparison between $V_u = \frac{x(\Omega)}{r}$ and $V_I = \frac{R_I}{r}$, then it follows :

$$\begin{aligned} \text{if } V_u > V_I &\Leftrightarrow x(\Omega) > R_I \Rightarrow \text{participant} \\ \text{else if } V_u \leq V_I &\Leftrightarrow x(\Omega) \leq R_I \Rightarrow \text{non participant} \end{aligned}$$

- The decision to participate stems from the comparison of the reservation wage, x , to the alternative income, R_I .

- It is well documented that the participation margin reacts to the overall labor market characteristics.
- For instance, when the labor market conditions are worsening **some workers may gave up looking for a job but would accept to work if they had an offer.**
- This latter effect is called the **discouraged workers effect.**
- **Definition (Discouraged workers)** : workers that are willing to work but give up searching because of the cost incurred.

The existence of discouraged workers suggests that the frontier between non-participation and participation in the labor force is difficult to draw.

Country	Discouraged workers	Job-seekers
Denmark	0.15	7.6
Spain	1.33	21.6
France	0.12	9.3
Germany	0.14	5.9
United States	0.65	8.9
Japan	1.04	4.5

Table 2 – Discouraged workers and job-seekers in 2011 (as a percentage of the labor force) Source : OECD data

- In the United States, individuals who employ passive methods are classed as non-participants, while numerous OECD countries consider job seekers employing both passive and active methods as unemployed.
- The distinction between non-participation and unemployment often turns out to be **arbitrary**.
- Jones and Riddell (1999) show that individuals classed as nonparticipants in Canada are anything but uniform in their behavior.¹³
- They distinguish 4 categories of individuals :
 - ① employed
 - ② unemployed
 - ③ individuals marginally attached to labor market (would like to work but are not looking for a job)
 - ④ non-participants

13. Jones and Riddell (1999), The measurement of unemployment : An empirical approach, *Econometrica*.

From ↓	To →	Employed	Unemployed	Non-participant +Marginally attached
Unemployed		0.112 (0.004)	0.708 (0.005)	0.180 (0.005)
Marginally attached		0.098 (0.005)	0.171 (0.007)	0.731 (0.008)
Non-participant		0.026 (0.001)	0.030 (0.001)	0.944 (0.002)

Table 3 – The transition matrix between different states in the labor market
 Monthly rates for the year 1992 in Canada (standard errors are in parentheses)
 Source : Jones and Riddell (1999)

- Jones and Riddell (1999) emphasize that the third category, non-participant plus marginally attached, is **extremely heterogeneous**.
- Consequently, we can deduce that the distinction between labor market participation and non-participation is fuzzy.
- As a result, it is generally useful to supplement them with other indicators in order to get a clear picture of the state of the labor markets.
- In this regard, the **employment rate** is an indicator frequently used to gauge what is happening in the labor market.¹⁴

14. Employment rates are defined as a measure of the extent to which available labour resources (people available to work) are being used. They are calculated as the ratio of the employed to the working age population.

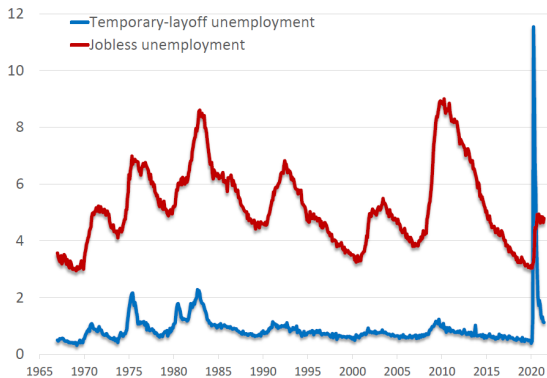
More on participation

- Unemployed workers may choose not to search because they **expect to be recalled by their former employer**.
- According to the country considered, they may be classified as participants or non participants.
- Hall and Kudlyak (2022) distinguish for two categories among the unemployed in the U.S. :¹⁵
 - ① jobless unemployment
 - ② temporary layoff unemployment
- Interestingly, they show that the second group has better prospects in the labor market and **lower social cost** due to shorter unemployment spells.
- Similar conclusions found in e.g. Fujita and Moscarini (2017).¹⁶

15. Hall and Kudlyak (2022), The Unemployed with Jobs and without Jobs, *Labour Economics*.

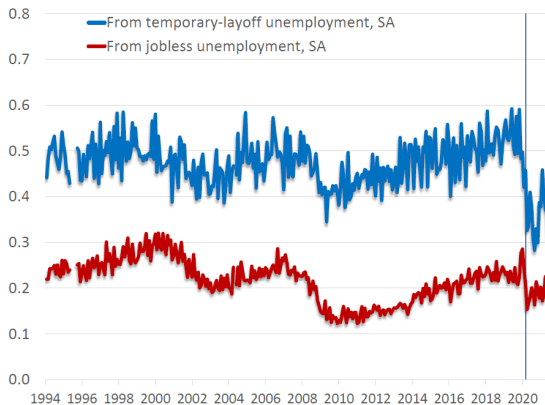
16. Fujita and Moscarini (2017), Recall and Unemployment, *American Economic Review*.

Jobless unemployment and temporary layoff unemployment



Source : Hall and Kudlyak (2022).

Exit rate from unemployment



Source : Hall and Kudlyak (2022).

More on participation (cont'd)

- **Recalls**, the process by which former employees who were previously laid off or furloughed are rehired by the same employer, is not peculiar to the US.
- Empirical evidence for other OECD countries are still scarce but show that the **phenomenon is far from negligible**.
- For instance, Charlot et al. (2023) document that between 2012 and 2019, **44.6% of entries into employment result from a recall in France**.¹⁷

Table 4: Overall entries into recalled employment

	2012	2013	2014	2015	2016	2017	2018	2019	Average
# of recalls	7,264,410	7,826,972	8,345,952	8,734,168	9,084,241	9,338,132	9,424,326	9,631,054	8,706,157
Share of recalls	(42.80%)	(44.35%)	(45.37%)	(45.92%)	(45.36%)	(44.72%)	(44.19%)	(44.25%)	(44.62%)
N	16,974,433	17,648,224	18,394,748	19,018,710	20,042,909	20,880,806	21,327,094	21,766,247	

Notes: Number and share of entries into recalled employment between 2012 and 2019 for all types of contracts (OECs, FTCs, and unknown contracts) in the non-farm private sector. Shares are computed as a percentage of total hires. Hence in 2019, among all entries into employment 44% were a recall with the last employer. Own calculations based on the 'Déclaration Préalables À l'Embauche (DPAE)'.

17. Charlot et al. (2023), Recalls in a Dual Labour Market : Insights from French Administrative Data, *unpublished manuscript*.

Solving the basic job search model

- Sketch of the procedure :
 - Set parameters (r, λ, q, z)
 - Choose the sampling distribution, $H(w)$, and set related parameters, e.g. assume a **log-normal distribution** :

$$H(w) \sim \log \mathcal{N}(\mu, \sigma)$$

- Find x as the solution of :

$$x - z - \frac{\lambda}{r + q} \int_x^{+\infty} (w - x) dH(w) = 0$$

- Derive model's outcomes : moments and comp. statics
- MATLAB script : [Simu_JobSearch.m](#)

Solving the basic job search model (cont'd)

main script `Simu_JobSearch.m`

```
%% SECTION 2: Solve for the reservation wage
%
%
options      = optimset('display','iter','Algorithm','trust-region-dogleg',...
    'Diagnostics','off','MaxIter',1000,'Tolfun',1e-6,'TolX',1e-6);

x0           = mu;
[x, fval]    = fsolve(@(x) eval_reservation_wage(x,par),x0,options);
rVu         = x; % Reservation wage
```

function `eval_reservation_wage.m`

```
function RW = eval_reservation_wage(x,par)
% update parameters
r      = par.r;
z      = par.z;
lambda = par.lambda;
q      = par.q;

% integral over [x,inf]
vint_rw = integral(@(w) int_rw(w,x,par),x,inf);

% Implicit function for the reservation wage
t0      = x-z-lambda/(1+q)*vint_rw;
RW      = t0;
return

function temp_int_rw = int_rw(w,x,par)
% update parameters
mu      = par.mu;
sigma   = par.sigma;

t0      = (w-x);
pdf      = lognpdf(w,mu,sigma);

temp_int_rw = t0.*pdf;
return
% EOF
```

Solving the basic job search model (cont'd)

Predicted moments :

```
>> Simu_JobSearch
```

Iteration	Func-count	f(x)	Norm of step	First-order optimality	Trust-region radius
0	2	1051.2		529	1
1	4	259.923	1	262	1
2	6	3.40192	0.991644	18.9	2.5
3	8	0.0401403	0.180116	1.61	2.5
4	10	1.3883e-05	0.0249655	0.0288	2.5
5	12	1.89557e-12	0.000482187	1.06e-05	2.5
6	14	1.72792e-26	1.78306e-07	1.02e-12	2.5

Equation solved.

fsolve completed because the vector of function values is near zero as measured by the selected value of the function tolerance, and the problem appears regular as measured by the gradient.

<stopping criteria details>

Wages:

```
Reservation wage.....: 3.40
Mean wage.....: 3.81
Standard dev.....: 0.35
```

Flows:

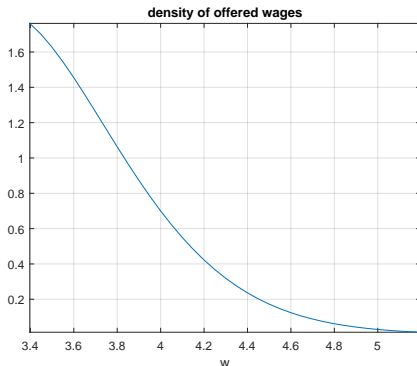
```
Job finding rate.....: 0.35
Job destruction rate.....: 0.04
```

Unemployment:

```
Unemployment rate.....: 0.10
Unemployment duration.....: 2.85
```

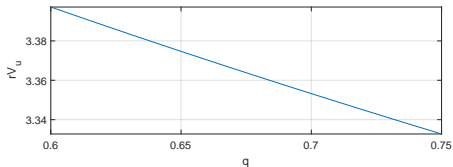
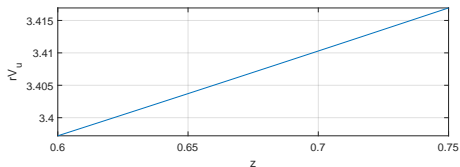

Solving the basic job search model (cont'd)

Wage distribution : The distribution of observed wages is truncated at the reservation wage $x = rV_u$ and is therefore different from the sampling distribution $H(w)$.



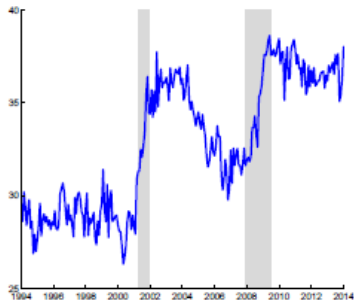
Solving the basic job search model (cont'd)

Comp. statics : Effects of an increase in z and q :



- The basic job search model is rich and tractable but yet (too) stylized.
- Some hypotheses are often deemed too restrictive.
- Fortunately, this framework can be easily extended to embed richer (more realistic) ingredients.
- In the next lecture, we will (among other things) :
 - Examine the consequences of the conditions of eligibility for unemployment insurance benefits.
 - Observe the implications of allowing an individual to seek a job while he is already employed.
 - Suppose that agents can decide how much effort to put into their job search.
 - ...

Search Intensity in the U.S. over the business cycle



Source : Mukoyama et al. (2018). Search intensity : The Average minutes of search per day in the U.S. (1994-2014).

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