Introduction - the economics of incomplete information

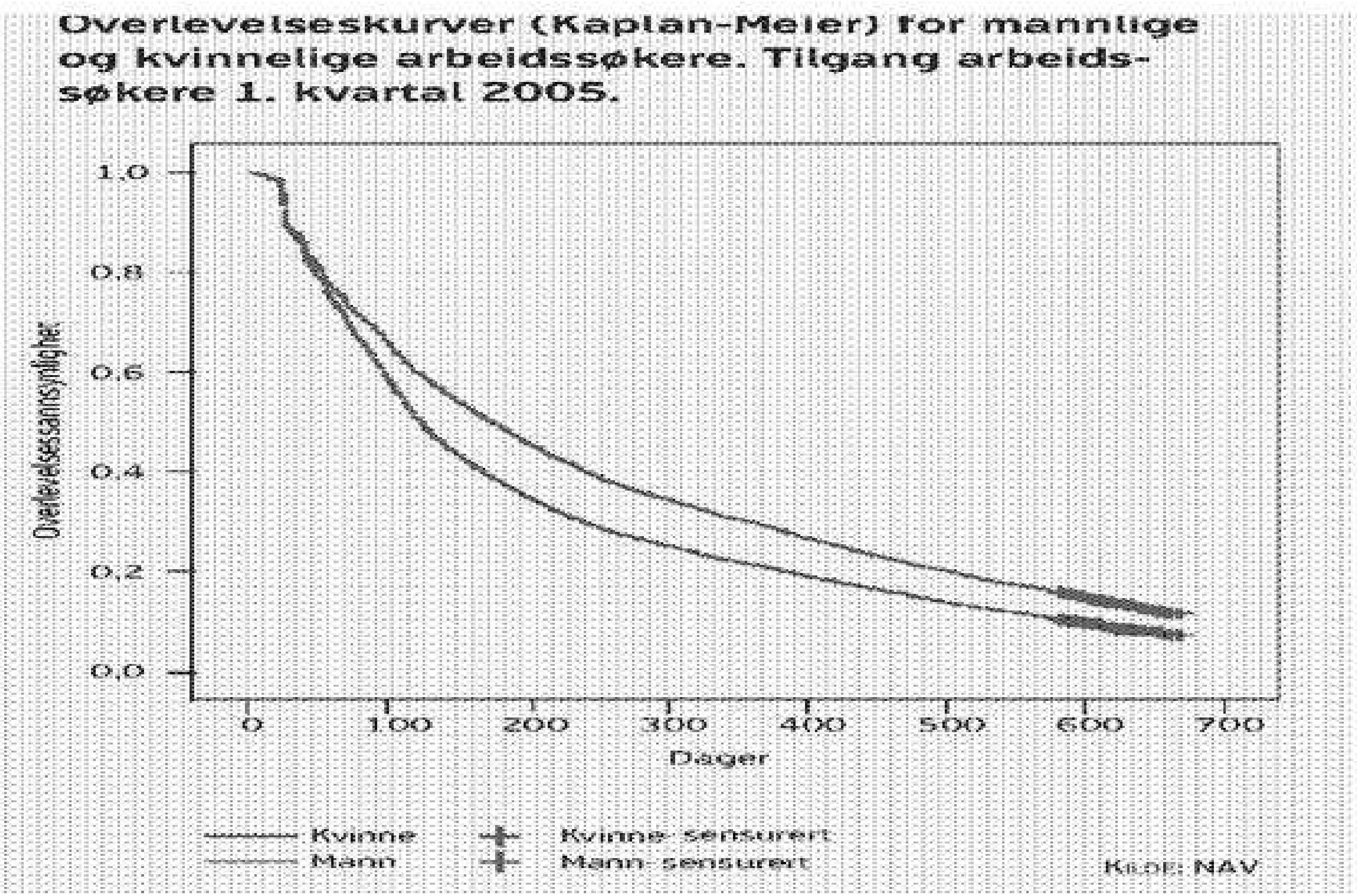
- Background: Neoclassical theory of labour supply: No unemployment, individuals either employed or nonparticipants.
- Alternatives:
  - Job search

    Workers have incomplete info on wages and jobs, but when employed effort/productivity is (usually) known/predetermined. Frictions.
  - Contract theory (agency and efficiency wage models)

    Contracts are known, but neither effort (P-A) nor production (efficiency) is verifiable.
  - Matching models

    Workers and firms have incomplete info on wages and jobs, but when employed effort/productivity is (usually) known/predetermined. Frictions.

Introduction - the economics of incomplete information



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The basic job search model

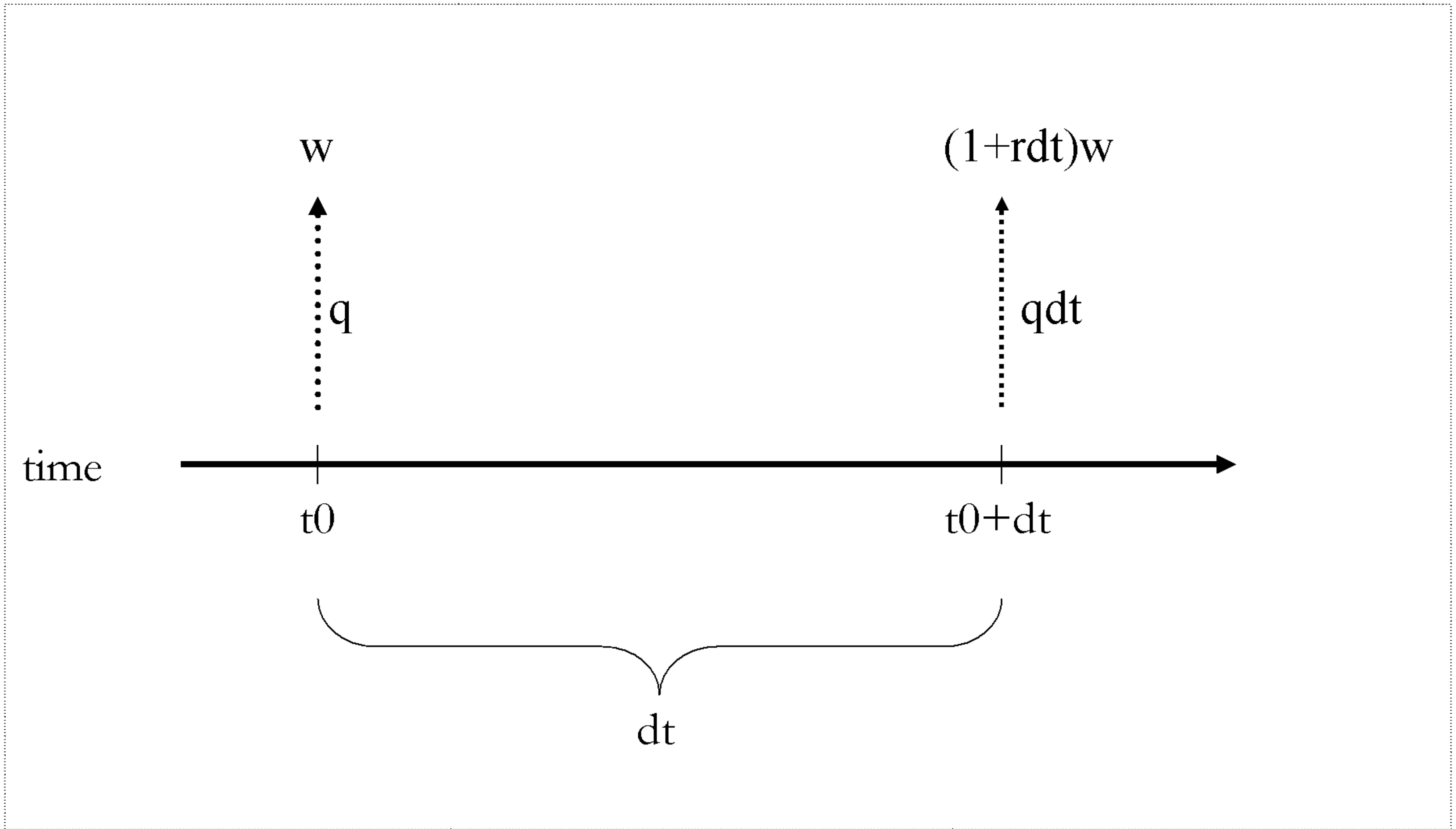
- Purpose: Derive an optimal search strategy for unemployed job seekers in terms of a reservation wage
- Basic assumptions:
  - Stationarity,
  - Risk neutral individuals,
  - No disutility of work (costless work effort),
  - Constant and exogenous interest rate (used to discount future utility)
  - No recall (when you get a job offer you can either accept or reject, cannot return to previous offers). A job offer comprises a wage w.
  - Let pay during unemployment, z, be equal to unemployment benefits, b, less search cost, c (z=b-c).

The basic job search model

- Model based on asset value functions or Bellman equations, stationary Poisson process future income
- Simplified version:
  - 1 Nok at time is worth 1+rdt Nok at time t+dt,
  - Thus discounting factor over a short time interval dt= 1/(1+rdt),
  - Over time dt any job may be destroyed at prob. qdt (q is exog.),
  - Over time dt a person receives job offers at prob. λdt (λ is exog.).
  - Discounted expected value of getting wage w: $\dfrac{1}{1+rdt}wdt$
  - Discounted expected value of keeping your job: $\dfrac{1}{1+rdt}(1-qdt)V_e$
  - Discounted expected value of becoming unemployed: $\dfrac{1}{1+rdt}qdtV_u$

future income

The basic job search model



The basic job search model

- 1) Discounted expected utility of employment V_e :

$$V_e = \frac{1}{1+rdt}\left[wdt + (1-qdt)V_e + qdtV_u\right]$$

- Multiplying 1) by 1+rdt and rearranging:

$$[1+rdt]V_e = wdt + (1-qdt)V_e + qdtV_u \quad \Leftrightarrow \quad \{(1+rdt)-(1-qdt)\}V_e = (w+qV_u)dt$$

$$\Leftrightarrow \quad \{r+q)\}V_e dt = (w+qV_u)dt$$

$$\Updownarrow$$

- 2)

$$rV_e = w + \underbrace{q(V_u - V_e)}_{\text{Average income (loss)}}$$

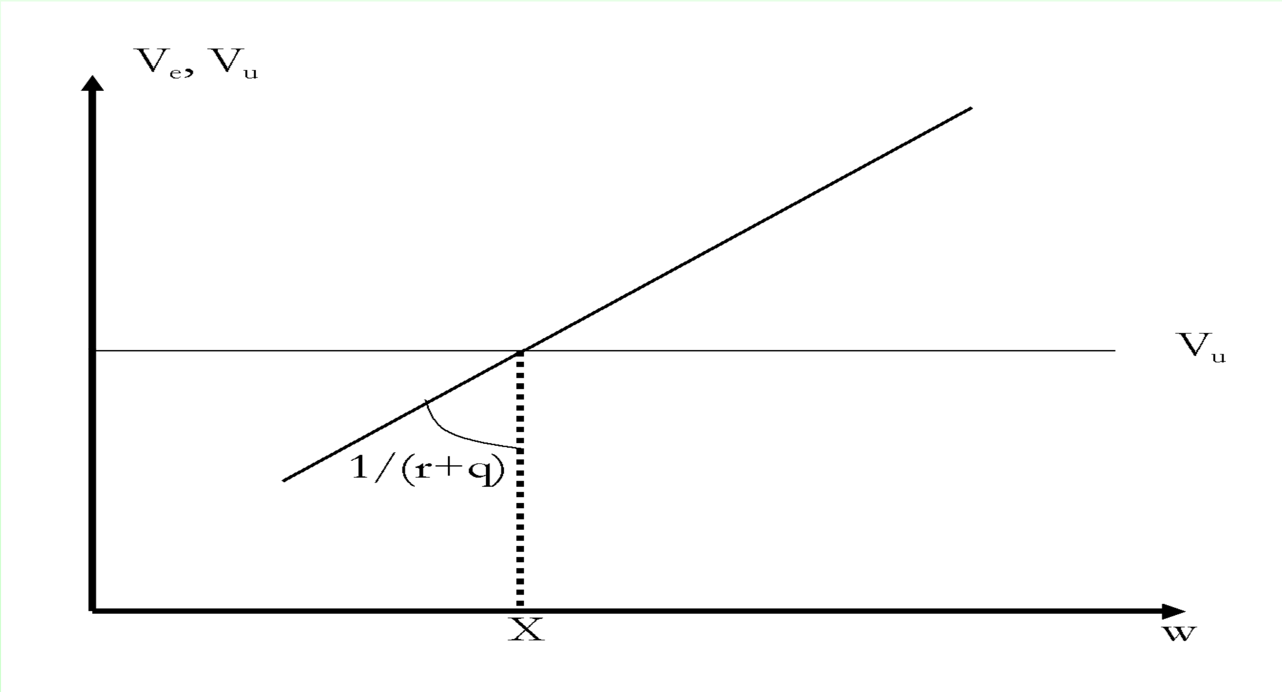
- 3) Discounted expected utility of an employee receiving wage w, V_e (w):

$$rV_e = w + q(V_u - V_e) \Leftrightarrow rV_e - rV_u = w + q(V_u - V_e) - rV_u \Leftrightarrow \underbrace{V_e(w) - V_u}_{\text{Increases in wages, decreases in discounted utility of unemployment}} = \frac{w - rV_u}{r+q}$$

Increases in wages, decreases in discounted utility of unemployment

The basic job search model

- Optimal search strategy
  - Accept a job offer if $V_e(w) > V_u$ (i.e., from 3) thus $w > r\,V_u$)
  - Otherwise reject job offer and continue search.
- Since V_u is independent of w this implies the existence of a unique reservation wage x, i.e., $x = rV_u$.

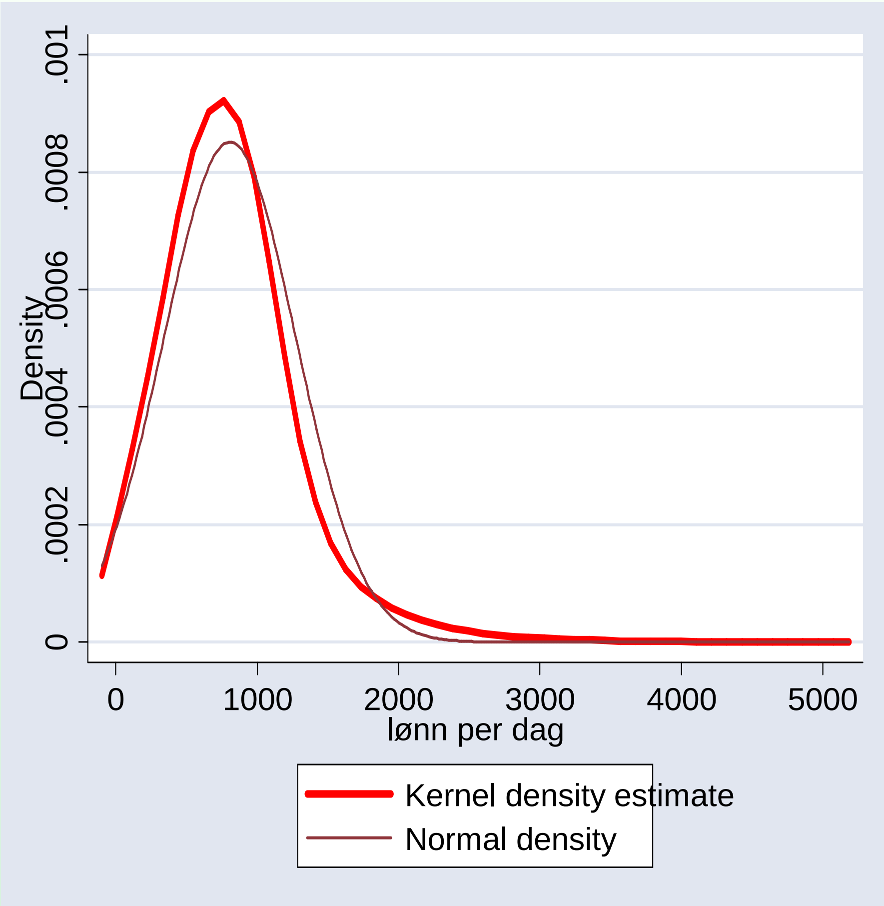


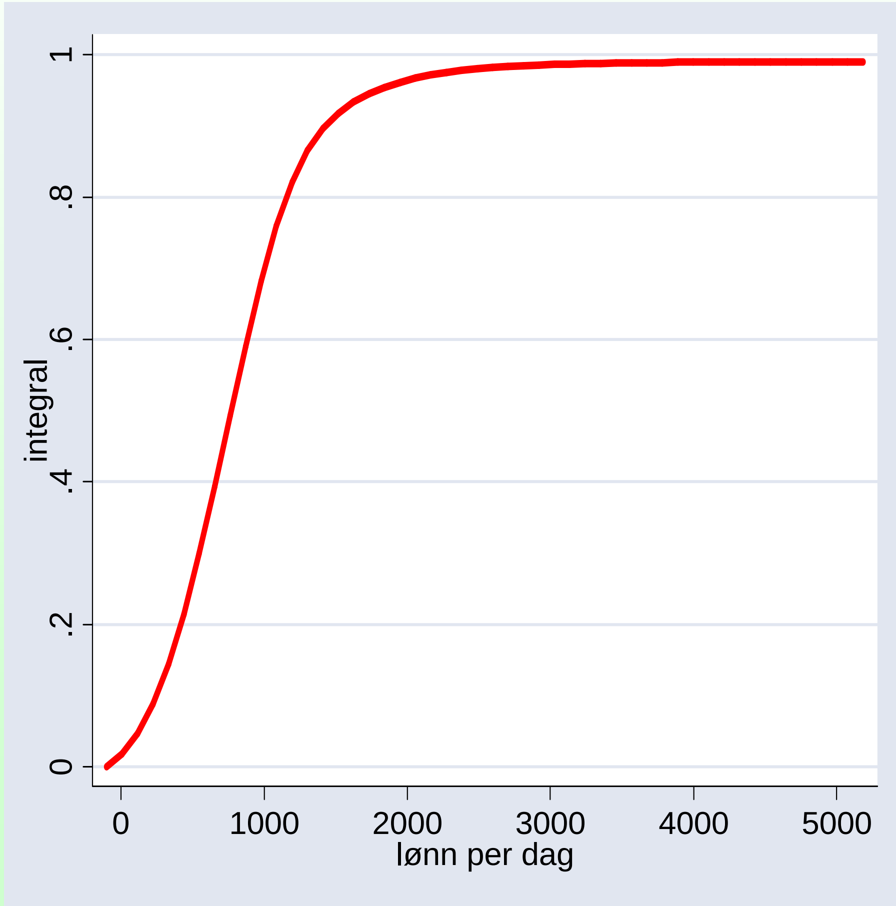
The basic job search model

- Assume that all possible wages (all that are offered) can be described by a probability distribution and this is known by all workers:

$$\Pr ob(W \leq w) = H(w) = \int_0^w h(w)dw$$

Wage distribution 2003 (1%-random sample)





The basic job search model

- The expected discounted value of unemployment can then be expressed as:

$$V_u = \frac{1}{1+rdt}\left[zdt + (1-\lambda dt)V_u + \lambda dt \underbrace{\left(V_u \int_0^x dH(w) + \int_x^\infty V_e(w)dH(w) \right)} \right]$$

$$\rightarrow \underbrace{V_u \int_0^x dH(w) + V_u \int_x^\infty dH(w)}_{\text{integral sums to 1, i.e., =Vu}} + \int_x^\infty V_e dH(w) - V_u \int_x^\infty dH(w) = V_u + \int_x^\infty (V_e(w) - V_u) dH(w)$$

$$\Rightarrow V_u[\cancel{1} + r\cancel{d}t - \cancel{1} + \lambda \cancel{d}t - \lambda \cancel{d}t] = z\cancel{d}t + \lambda \cancel{d}t \int_x^\infty (V_e(w) - V_u) dH(w)$$

4) $$\Rightarrow \underbrace{rV_u}_{\text{Rate of return on unemployment state}} = z + \underbrace{\lambda}_{\text{Probability of job offer}} \underbrace{\int_x^\infty (V_e(w) - V_u) dH(w)}_{\text{Expected gain from a job transition}}$$

The basic job search model

- Since we know that the reservation wage must satisfy $x=rV_u$ thus Equation 3) give:

$$V_e(w)-V_u=\frac{w-rV_u}{r+q}=\frac{w-x}{r+q}$$

- and together with 4) we find:

$$rV_u=z+\lambda\int_x^{\infty}\left(V_e(w)-V_u\right)dH(w)\Rightarrow x=z+\frac{\lambda}{r+q}\int_x^{\infty}\left(w-x\right)dH(w) \quad 5)$$

- Equation 5) expresses an optimal reservation wage for the unemployed. This can be shown (see assignment/seminar) using Leibniz' rule.

The basic job search model

- Given knowledge about the reservation wage, we can derive both the exit rate from unemployment and the average duration of unemployment:
  - Exit rate from unemployment:

$$\lambda \underbrace{[1 - H(x)]}_{\text{Probability of accepting a wage offer}}$$

Probability of getting a wage offer

  - Expected duration of unemployment:

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

The basic job search model

- How sensitive is the reservation wage to changes in the underlying parameters and how is duration affected?

- To see the answer to these to questions, one has to rewrite 5) in the form:

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

and differentiate it conditional on $\Phi=0$.

The basic job search model

- How sensitive is the reservation wage to changes in the underlying parameters and how is duration affected?

- Basic results (see assignment/seminar):
  - Increased net income as unemployed increases the reservation wage and causes longer unemployment duration,
  - Increased job destruction rate reduces the reservation wage and since it reduces the value of waiting for a better job, unemployment duration decreases.
  - Higher interest rate reduces the reservation wage and decreases unemployment duration.
  - Higher job offer arrival rate clearly increases the reservation wage, but has an ambiguous impact on the unemployment duration.

Extensions of the basic model

- Eligibility
- On the job search
- Choosing how hard to search for jobs

Extension 1 Eligibility and UI benefits

- To be eligible for UI benefits, you need to have had 1 job, thus some workers are not eligible for UI benefits. (q and λ equal).
- Assume income as unemployed and eligible: z
- Assume income as unemployed and non-eligible: $z_{n,}$ $z_n<z$
- For the eligible job seekers nothing change.
- For the non-eligible job seeker a job provides:

$$rV_e = w + q(V_u - V_e)$$

Vu refers to the expected utility of an eligible job-seeker since getting the first job qualifies for UI benefits. Note: $V_e(x_n) = V_{un}$

- Thus the expected utility of the non-eligible job seekers can be written:

$$rV_{un} = \frac{rx_n + qx}{r+q}$$

Extension 1 Eligibility and UI benefits

- Since q and λ equal (do not depends on eligibility) the expected utility of an non-eligible job seeker can be expressed:

$$rV_{un} = z_n + \lambda \int_{xn}^{\infty} (V_e(w) - V_{un}) dH(w)$$

- which then again can be transformed (see assignment/seminar) into:

$$rx_n = (r+q)z_n - qx + \lambda \int_{xn}^{\infty} (w - x_n) dH(w)$$

- Implications: negative relation between the reservation wage of non-negligible and eligible job seekers (i.e., xn and x).
- Thus if z increases, the reservation wage of eligible workers increase and their unemployment duration increases, while the reservation wage of non-eligible job seekers drops and their unemployment duration is reduced. For the economy?