

Estimating Equilibrium Effects of Job Search Assistance

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Introduction

- ▶ Evaluation of active labor market policies (ALMP's):
 - ▶ Randomized experiments are viewed as the gold standard
- ▶ Goal: large-scale roll out of a program
- ▶ Spillover and congestion effects are often ignored

Overview

This paper:

1.
 - ▶ Randomized experiment in two counties in Denmark (mainly job search assistance) (Graversen & van Ours (2008), Rosholm (2008) find large effects)
 - ▶ Use non-experiment counties to estimate (dif-in-dif) effect on participants AND non-participants
2.
 - ▶ Construct an equilibrium matching model with job search assistance
 - ▶ Use empirical findings as auxiliary models to estimate the model
 - ▶ Predict effect of large-scale roll-out

Contribution

- ▶ to treatment literature: allow for general-equilibrium effects and estimate welfare effects
- ▶ to macro labor: use outcome of a randomized experiment to estimate an equilibrium search model

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- ▶ Net effect close to zero
- ▶ No effect on wages or hours worked
- ▶ Increase in vacancies (imprecisely measured) during experiment
- ▶ Equilibrium search model: large scale roll out has negative effect on job finding, welfare maximised for 0% participation

- ▶ Importance of general equilibrium effects in the labor market
 - ▶ Crepon et al. (2013), Blundell et al. (2004), Cahuc and Le Barbanchon (2010), Ferracci et al. (2010), Lise, Seitz and Smith (2003), Lalive et al. (2013)

- ▶ Effect of the Danish activation program
 - ▶ Graversen & van Ours (2008), Rosholm (2008), Vikström (2011)

- ▶ Equilibrium search model
 - ▶ Diamond (1982), Mortensen (1982), Pissarides (2000)
 - ▶ Albrecht, Gautier and Vroman (2004)

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 2. After 5-6 weeks: intensive two-week job search assistance program
 3. After 7 weeks: weekly or biweekly meetings with caseworker
 4. After 4 months: caseworker decides about follow-up program

The Danish experiment

- ▶ Evaluation through randomized experiment in two Danish Counties
 - ▶ map
- ▶ Experiment involved all UI applicants between November 2005 and February 2006:
 - ▶ 50% randomly selected to participate in treatment
- ▶ Controls received usual assistance (meetings every 3 months)

The Danish experiment

- ▶ Graversen & van Ours (2008) and Rosholm (2008) find that participants have 30% higher exit rate from unemployment
- ▶ Threat effect (of announcement) and job search assistance / meetings are important
- ▶ All studies ignore equilibrium effects
- ▶ Towards end of experiment almost 30% of stock of unemployed in program
- ▶ Experiment outcomes contributed to intensification of job search assistance in Denmark

Treatment externalities

- ▶ Treatment effect (with N individuals):

$$\Delta_i(D_1, \dots, D_N) \equiv E[Y_{1i}^* | D_1, \dots, D_N] - E[Y_{0i}^* | D_1, \dots, D_N]$$

- ▶ If SUTVA ($(Y_{1i}^*, Y_{0i}^*) \perp D_j, \forall j \neq i$) holds, then

$$\Delta_i = E[Y_{1i}^*] - E[Y_{0i}^*]$$

- ▶ Can be estimated by difference-in-means
- ▶ If SUTVA violated, difference-in-means estimator only provides effect at given treatment intensity $\bar{D}_N = \frac{1}{N} \sum_{i=1}^N D_i$.
- ▶ Policy relevant treatment effect for large-scale roll out:

$$\Delta = \frac{1}{N} \sum_i E[Y_{1i}^* | \bar{D}_N = 1] - E[Y_{0i}^* | \bar{D}_N = 0]$$

- ▶ Identification requires observing labor markets with different treatment intensities.

Treatment externalities

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- ▶ workers compete for the same jobs
- ▶ more congestion due to increased search effort
- ▶ increase in search intensity affects vacancy supply
- ▶ equilibrium wages change

Data

Unemployment durations

- ▶ Administrative data on unemployment duration of inflow in **all** Danish counties in
 - ▶ November 2003 – February 2005 (pre-experiment period)
 - ▶ November 2005 – February 2006 (experiment period)
- ▶ Pre-experiment periods: similar exit rates in experiment and comparison regions ▶ Survivor
- ▶ In experiment period substantial differences (p -value < 0.01) ▶ Survivor

Vacancies

- ▶ Monthly stock of vacancies in **all** counties between Jan04 and Nov07 (National Labor Market Board)

Summary statistics

Table: Summary statistics.

	Experiment counties			Comparison counties	
	2004–2005	Treatment	Control	2004–2005	2005–2006
Hours worked (per week)	35.4	36.6	34.9	35.0	36.1
Earnings (DK per week)	5950	6271	6160	6256	6586
Male (%)	54.6	60.8	59.2	53.0	52.4
Age	42.0	42.4	42.3	41.3	41.2
Native (%)	94.8	93.2	94.4	93.7	93.0
West. Immigrant (%)	3.2	4.0	3.4	2.8	3.2
Non-West. Immigrant (%)	2.0	2.8	2.2	3.5	3.8
Benefits previous year (in weeks)	10.5	9.8	9.0	10.2	11.1
Benefits past two years (in weeks)	12.7	12.3	11.9	12.5	13.8
Previous hours worked (per week)	27.5	28.4	28.5	27.1	27.0
Previous earnings (DK per week)	4903	5191	5436	4993	5113
Education category: (%)					
1 (no qualifying education)	34.6	35.8	40.5	33.7	37.3
2 (vocational education)	49.4	50.7	47.6	45.2	44.2
3 (short qualifying education)	4.1	4.9	3.5	4.7	4.8
4 (medium length qualifying education)	9.8	5.9	6.3	11.6	8.7
5 (bachelors)	0.5	0.8	0.8	0.8	2.1
6 (masters or more)	1.5	1.9	1.3	4.0	3.1
Observations	5321	1496	1572	37,082	31,586
Unemployment rate (%)	6.1		5.0	5.7	4.8
Participation rate (%)	76.3		76.3	79.2	79.1
GDP/Capita (1000 DK)	197.5		201.3	219.8	225.1

Unemployment durations

Binary outcomes: probability of exit with 3,6 or 24 months

$$E_i = \alpha_{r_i} + \mathbf{x}_i\beta + \delta\mathbf{d}_i + \gamma\mathbf{c}_i + \eta_{\zeta_i} + U_i \quad (1)$$

- ▶ County fixed effects (α_{r_i}) control for county differences
- ▶ Time trend is captured by η_{ζ_i} (two-periods)
- ▶ Parameters of interest:
 - ▶ δ , treatment effect on treated
 - ▶ γ , treatment effect on non treated

Table: Estimated effects of the activation program on exit probabilities of participants and nonparticipants.

	three months		one year		two years	
	(1)		(2)		(3)	
Participants	0.059	(0.007)***	0.039	(0.004)***	0.010	(0.005)**
Nonparticipants	-0.033	(0.014)**	0.013	(0.003)***	-0.006	(0.003)**
Base ^a	0.500		0.901		0.969	
Ind. characteristics	yes		yes		yes	
County fixed effects	yes		yes		yes	
Observations	77,057		77,057		77,057	

Unemployment durations

- ▶ Exit rate from unemployment for individual i in observation period τ_i

$$\theta(t|\zeta_i, r_i, \mathbf{x}_i, \mathbf{d}_i, \mathbf{c}_i) = \lambda_{\zeta_i}(t) \exp(\alpha r_i + \mathbf{x}_i \beta + \delta \mathbf{d}_i + \gamma \mathbf{c}_i)$$

- ▶ Same variables
- ▶ Stratified partial likelihood estimation allows for nonparametric baseline hazards $\lambda_{\zeta_i}(t)$ that differ between observation periods.

Unemployment durations

	Data censored after:					
	2 years		1 year		3 months	
	(1)		(2)		(3)	
Participants	0.154	(0.031)***	0.167	(0.032)***	0.151	(0.042)***
Nonparticipants	-0.044	(0.030)	-0.031	(0.031)	-0.115	(0.044)***
Individual characteristics	yes		yes		yes	
County fixed effects	yes		yes		yes	
Observations	77,057		77,057		77,057	

Vacancies

- ▶ Stock of vacancies in county r at month t ,

$$\log(V_{rt}) = \alpha_t + \delta D_{rt} + \theta_r + U_{rt}$$

	(1)	(2)	(3)
Experiment	0.047 (0.050)		
Experiment nov/dec 2005		0.057 (0.084)	0.007 (0.055)
Experiment jan/feb 2006		0.067 (0.032)*	0.016 (0.032)
Experiment mar/apr 2006		0.081 (0.033)**	0.031 (0.041)
Experiment may/june 2006		0.182 (0.046)***	0.132 (0.034)***
Experiment july/aug 2006		0.114 (0.027)***	0.064 (0.031)*
Experiment sept/oct 2006		-0.049 (0.046)	-0.099 (0.068)
County fixed effects	yes	yes	yes
Month fixed effects	yes	yes	yes
Observation period	Jan 04–Dec 07	Jan 04–Dec 07	Jan 05–Dec 06

Wages and hours worked

- ▶ Annual earnings and hours worked available for years after the unemployment spell
- ▶ Similar analysis possible for effect program on wages/hours worked participants and non-participants
- ▶ No effect of program found on wages and hours

Equilibrium search model

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- ▶ Construct and estimate an equilibrium search matching model with treatment externalities.

Equilibrium search model

- ▶ Effects of activation program at given treatment intensity:
 - ▶ participants in the activation program find jobs faster
 - ▶ non-participants have lower exit rates
 - ▶ more vacancies are opened in treatment regions (but large s.e.)
- ▶ Construct and estimate an equilibrium search matching model with treatment externalities.
- ▶ Use model to predict effect of different treatment intensities

Equilibrium search model

- ▶ Unemployed worker:
 - ▶ receives benefits b
 - ▶ chooses number of applications a
- ▶ Unit of time is time to process a job application (1 month)
- ▶ Success rate of applications depends on what other workers and firms do and is summarized by matching function $m(a; \bar{a}, \theta)$, with $\theta = v/u$
- ▶ If application is successful, worker becomes employed and receives wage w :
 - ▶ Nash bargaining
 - ▶ Bertrand competition
- ▶ Value of non-market time h (for non-participants)
- ▶ Activation program changes the costs of an application ($\gamma_1 \neq \gamma_0$)

Equilibrium search model

- ▶ Value functions unemployed:

$$rU_0 = \max_{a \geq 0} b + h - \gamma_0 a^2 + m(a; \bar{a}, \theta)(E(w) - U_0)$$

$$rU_1 = \max_{a \geq 0} b - \gamma_1 a^2 + m(a; \bar{a}, \theta)(E(w) - U_1)$$

- ▶ Optimal number of applications follows from first-order condition

$$a^* = \frac{E(w) - U_i}{2\gamma_i} \frac{\partial m(a; \bar{a}, \theta)}{\partial a} \Big|_{a=a^*} \quad i = 0, 1$$

$\bar{a} = \tau a_1^* + (1 - \tau)a_0^*$ and τ is the treatment intensity.

Equilibrium search model

- ▶ p is productivity , c_v is vacancy creation cost,
- ▶ Value function employed:

$$rE(w) = w - \delta(E(w) - \bar{U}(\tau))$$

with $\bar{U} = \tau U_1 + (1 + \tau)U_0$.

- ▶ Value of filled job:

$$rJ = p - w - \delta(J - V)$$

- ▶ Value of vacancy:

$$rV = -c_v + \frac{m(\bar{a}, \theta)}{\theta}(J - V)$$

Matching function

- ▶ Adjust Albrecht et al. (2006) urn-ball matching function:

- ▶ Workers randomize over vacancies
- ▶ Vacancies randomly pick one applicant and reject the rest
- ▶ Two coordination problems
- ▶ Expected number of applications per vacancy $\frac{u(\tau a_1^* + (1-\tau)a_0^*)}{v} = \bar{a}$
- ▶ Pr(application results in offer):

$$\psi = \frac{\theta}{\bar{a}} \left(1 - \exp\left(-\frac{\bar{a}}{\theta}\right) \right)$$

- ▶ Matching rate for workers

$$m = 1 - (1 - \psi)^{\bar{a}}$$

Equilibrium search model

- ▶ Steady state flow condition
- ▶ Free entry of vacancies, $V = 0$
- ▶ Nash wage bargaining

Government expenditure and Welfare

- ▶ Decision variable for policy maker is τ (treatment intensity)
- ▶ Government expenditure:

$$GS(\tau) = bu + \delta(1 - u)\tau c_p$$

- ▶ Welfare (net output), $\Omega(\tau) =$

$$(1 - u)y + u \left((1 - \tau) \frac{h - \gamma_0 a_0^{*2}}{1 + r} + \tau \frac{-\gamma_1 a_1^{*2}}{1 + r} \right) - \delta(1 - u)\tau c_p - v c_v$$

Estimating the model: moment conditions

Table: Moment conditions.

	Data moment	Description	Corresponding value model
Unemployment rate	5.0%	Unemployment rate Storstrøm and South Jutland during the experiment	$u^* \tau = \tau^e$
Program effect on log vacancies	0.081	Estimated percentage effect on vacancies 5-6 months after the beginning of the experiment	$\frac{(v^* \tau = \tau^e) - (v^* \tau = 0)}{(v^* \tau = 0)}$
Program effect on participants	0.059	Estimated effect	$[1 - (1 - (m_1 \tau = \tau^e))^3] - [1 - (1 - (m_0 \tau = 0))^3]$
Program effect on nonparticipants	-0.033	Estimated effect	$[1 - (1 - (m_0 \tau = \tau^e))^3] - [1 - (1 - (m_0 \tau = 0))^3]$
Outflow rate after three months	0.51	Fraction of unemployed in Storstrøm and South Jutland that leaves unemployment within three months	$1 - \tau(1 - (m_1 \tau = \tau^e))^3 - (1 - \tau)(1 - (m_0 \tau = \tau^e))^3$
Vacancy rate	1.0%	Approximation of the number of vacancies as a percentage of the labor force in Storstrøm and South Jutland	$v^* \tau = 0.3$
Replacement rate	0.65	Unemployment benefits are 65% of the wage level	$\frac{b}{w^*} \tau = \tau^e$

Estimating the model

Table: Matching of moments

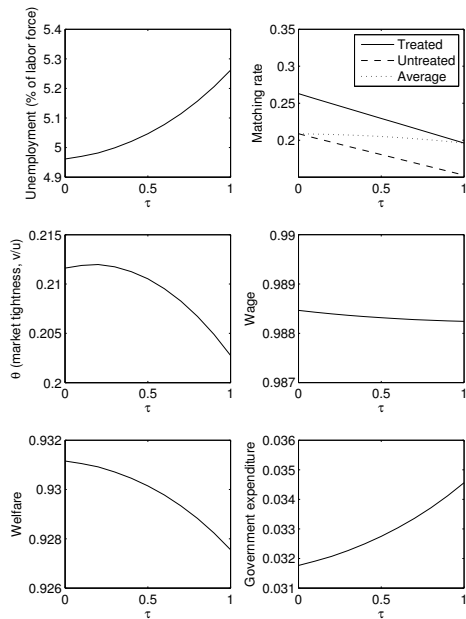
	Data moments	Model moments	Difference (in %)
Unemployment (for $\tau=0.3$)	0.05	0.05	0.00
Vacancy increase (%)	0.081	0.008	-89.88
Effect on non-treated	-0.033	-0.033	-0.91
Effect on treated	0.059	0.061	3.90
Outflow within 3 months	0.5	0.5	-0.02
Vacancy rate	0.01	0.01	5.00
Replacement rate	0.65	0.65	-0.35

Estimating the model

Table: Parameter values.

<i>Fixed parameter values</i>		
τ^e	0.3	30% of the unemployed workers are treated in the experiment
r	0.008	annual discount rate equals 10%.
y	1	productivity normalized to 1
<i>Estimated parameter values</i>		
γ_0	0.216 (0.003)	cost of sending an application for nonparticipants
γ_1	0.116 (0.027)	cost of sending an application for program participants
h	-0.014 (0.011)	value non-market time for nonparticipants
b	0.640 (0.173)	UI benefits
δ	0.011 (0.011)	job destruction rate
c_v	0.603 (0.008)	per period cost of posting a vacancy
β	0.814 (0.223)	bargaining power

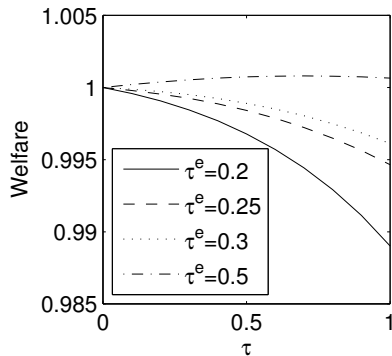
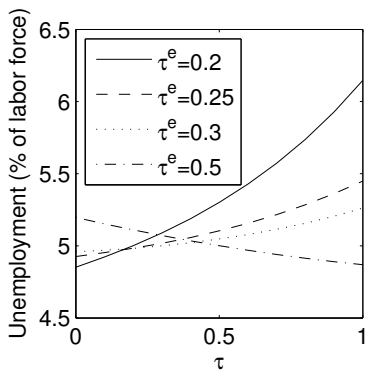
Policy simulations



Robustness

- ▶ Matching function: Cobb-douglas cannot reproduce empirical findings
- ▶ Wages: Bertrand competition leads to similar results in terms of welfare
 - ▶ Simulation results
- ▶ Fraction of treated in experiment (τ^e): lower values lead to larger decrease in welfare
 - ▶ Estimates of spillovers are lower bound

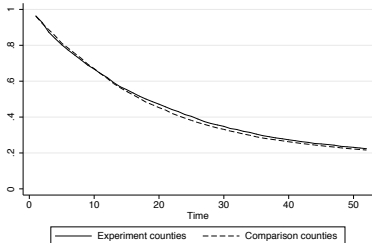
Robustness: lower values of τ^e



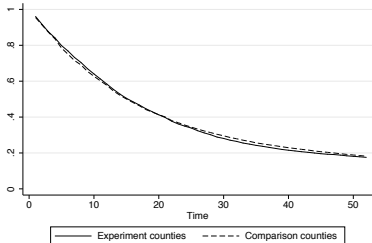
Conclusions

- ▶ Use data from randomized experiment on Danish activation program for unemployed workers.
- ▶ Empirical results indicate
 - ▶ Existence of "treatment effect on the non treated".
 - ▶ Positive effect on vacancy creation.
- ▶ Equilibrium search model can match the effects of the activation program.
- ▶ Simulations show that a large-scale roll out of the program substantially reduces effects found in randomized experiment and has negative welfare effects.

Nov. 2003 – Feb. 2004

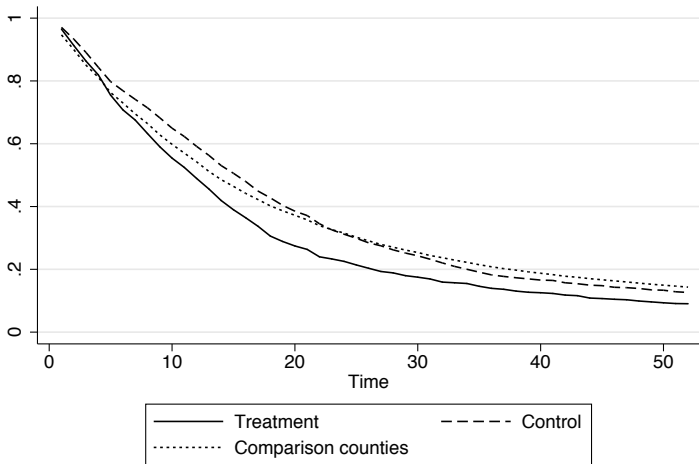


Nov. 2004 – Feb. 2005



▶ back

Nov. 2005 – Feb. 2006



▶ back

