Groping in the Dark?
How Useful are Posted Job Openings ?*

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— preliminary and incomplete version - please do not circulate —

Abstract

Policy makers and researchers often rely on posted job openings when estimating matching functions and evaluating labor market efficiency. It is well-known that the these is are only a fraction of all job openings in the economy, but less is known about how this fraction vary across time and firms. First, we set up a simple search-and-matching model with two recruitment channels and illustrate how changes in the fraction of announced job-openings can lead to a bias in the estimated matching efficiency. Second, we construct a new database with actual hires and announced openings using data from the Danish tax authorities and public employment service. Using this we document how the share of hires via announced openings vary across time, firm and job characteristics. Third, we use the data to calibrate our model and shows that accounting for swings in the fraction of posted job openings significantly changes the estimated matching efficiency and Beveridge curve movments.

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1 Introduction

- Announced job openings are heavily used by policy makers and researchers.
- Recently, a debate among policy makers and academics about what Beveridge Curve has shifted in the wake of the Great Recession (e.g. Draghi Jackson hole speech). Changed matching efficiency has been one of the suspected culpitts.
- An alternative theory is a change in the share of announced job-openings. In Europe most long series for job-openings relies on annonuced job-openings (Elsby et al., 2014) and it is a well-appreciated point this is this is only a fraction of all job-openings.
- In this study we use novel Danish data on the firm level to investigate:
  - How big is the fraction of announced job-openings?
  - Is it constant over time?
  - And how does it vary by firm and worker characteristics?
- Summary of findings.
- Our contribution.
- This paper is organized . . .

2 A Review of the Literature

- A substantial literature on the behaviour of job-openings. A complete survey is beyond the scope of this text, but we refer to Elsby et al. (forthcoming).
  - A early literature on the help-wanted index for job-openings (Abraham, 1983; 1987)
  - Big literature which relates the aggregate number of job-openings and unemployed workers to number of hires (e.g. Blanchard and Diamond, 1989; Shimer, 2005;)
  - Especially relevant are studies using vacancy behaviour from centralized registers (Coles and Smith, 1996; Albaek and Hansen, 2004; Berman, 1997; Yashiv, 2000; Andrews, 2008; Sunde, 2007)
  - Also related is the literature which analyzes the duration of job-openings and their determinants (Ours and Ridder, 1991; Burdett and Cunningham, 1998; Barron et al., 1999; Holzer, 1990).
  - But literature that relates job-openings to job hirs on the firm level is very scarce (Haltiwanger et al., 2013).

3 A Simple Model

- A simple model that allows for two hiring channels.

- Purpose: (1) to illustrate how changes in the fraction of announced openings can shift the perceived matching efficiency. (2) Construct a framework that allows us to trace out the stock of unannounced job openings from the flow of hires.

In this section we set up a simple search-matching model of the labor market. The model builds heavily on the framework by the cannonical model by Pissarides [SOURCE][1], but will allow firms and workers to match via two channels: announced and unannounced job-openings. The purpose of this model is twofold. First, to illustrate how changes in the posting behavior of firms can shift the perceived matching efficiency in the economy. Second, to construct a framework that empirically will allow us to trace out the stock of announced and unannounced job openings in the economy (Section X).

The model

The Matching Functions

The only non-standard element in our model will be the existence of two matching function - each with one type of job-openings. Unemployed search on both markets, while firms post all openings and keep λ unposted. Specifically, unemployed workers and announced openings are matched according to the function

$$M_A(U,O_A) = A_a U_a^{\alpha} O_A^{1-\alpha} \tag{1}$$

while unemployed and unannonced openings are matched according to

$$M_U(U,O_A) = A_u U_u^{\alpha} O_U^{1-\alpha} \tag{2}$$

It follows that the probability of filling an announced opening is $m_A(\theta) \equiv \frac{M_A(U,O_A)}{O_A}$, while the probability for a unemployed to match into a announced opening is $\theta m_A(\theta)$. Similarly, the probability of filling an unannounced opening is $m_U(\kappa)$ while the chance for an unemployed to matching in to such a position is $\kappa m_U(\kappa)$.

[Insert figure here]

Workers

Let us proceed to describe the value functions of employed and unemployed workers, V_e and V_u. When employed the worker enjoys a real wage of w, while loosing the job with an exogenous rate q. Thus, we can write the value function of being employed as

$$rV_e = w + q(V_u - V_e) \tag{3}$$

[1] So far our source is the 2000 textbook, but we should do better than this.

When unemployed the worker receives unemployment benefits of z, while matching into a job with probability $\theta m_A(\theta) + \kappa m_A(\kappa)$. Therefore, the value function of being unemployed reads

$$rV_u = z + [\theta m_A(\theta) + \kappa m_A(\kappa)](V_u - V_e \tag{4}$$

Firms

The value of a filled position depends on the firm's income stream from the position (productivity minus wage) plus the expected net loss from the possibility of job destruction.

$$r\Pi_e = y - w + q(\Pi_T - \Pi_e) \tag{5}$$

The value of a posting and unposted job-opening, respectively, reads

$$r\Pi_A = -C_a + m_A(\theta)(\Pi_e - \Pi_A) \tag{6}$$

$$r\Pi_u = -C_u + m_A(\theta)(\Pi_e - \Pi_U) \tag{7}$$

Here C_a reflects the job-posting cost, while C_u reflects the cost of recruiting via other channels. [Add more here]

Assuming that job-opening are created until there is no profit to gain from creating additional openings[2] ($\Pi_U = \Pi_A = 0$) we get two labour demand curves.

$$\frac{C_a}{m(\theta)} = \frac{C_u}{m(\kappa)} = \frac{y - w}{r + q} \tag{8}$$

Wage bargaining

Wages are determined via usual Nash bargaining, why workers and firm split the surplus from the match via the usual Nash-bargaining solution.

$$\beta\Pi_e = (1 - \beta)(V_u - V_e) \tag{9}$$

Here β is the bargaining strength of the worker.

The Augmented Beveridge curve

Finally, we can note that the dynamics of unemployed in this model will follow the following dynamics.

$$\dot{U} = \dot{N} + qL - [\theta m_A(\theta) + \kappa m_U(\kappa)]U \tag{10}$$

[2] The free entry condition holds

which in steady state relates the unemployment rate to both types of job-openings via an *augmented Beveridge curve*.

$$u = \frac{n+q}{\theta m_A(\theta) + \kappa m_A(\kappa) + n + q} \tag{11}$$

Unlike the standard Beveridge curve this in three dimensions as it relates unemployment to both posted and unposted job-openings. As we shall see below this feauture of the model will turn out to be important.

[Insert figure 3d figure here]

Equilibrium

In sum, the equilibrium of our model is described by 6 equations with 6 unknown variables.

$$u = \frac{n+q}{\theta m_A(\theta) + \kappa m_A(\kappa) + n + q} \tag{12}$$

$$\frac{C_a}{m(\theta)} = \frac{C_u}{m(\kappa)} = \frac{y-w}{r+q} \tag{13}$$

$$w = \beta y + r(1-\beta)V_u \tag{14}$$

$$V_e - V_u = \frac{\beta}{1-\beta}\frac{y-w}{r+q} = \frac{w-z}{\theta m_A(\theta) + \kappa m_A(\kappa) + r + q} \tag{15}$$

A Numerical illustration

Table 1 describes our calibritation strategy.

Table 1: Calibration

Parameter	Value	Source/target
y	1	
r	.05	
q	.15	
z	1	
β	.5	
α	.5	
A_a	1	
A_u	1	
C_a	.5	
C_u	.5	

Now lets numerically investigate the impact of a changing fraction of announced vacancies on the *perceived* matching efficiency. Perceived matching efficiency refers to the circumstance that an economist analyzing a labor market only observes the number of announced job openings. Perceived matching efficiency will thus relate unemployment to the number of announced job openings. We will do this via an (i) estimated matching efficiency parameter in a matching function or (2) via a twodimentional Beveridge that relates the announced job openings to unemployment.

Specifically we will use analyse simulated data from the model. By using the model as a data-generating proces we can generate time series for announced job openings and unemployment. We can then use this data to illustrate how the perceived matching effiency and Beveridge curve shift, when there is a drop in the relative cost of announced job openings.

Table 2 shows how a increase in the relative cost of posting job-openings will increase the perceived matching efficiency in the economy. In the specific calibration a 20 percent increase in the relative costs of announced job openings will increase the perceived matching efficiency with 7 percent. The higher cost of announced job openings will induce the firms will shift their recruitment efforts from announced to unannounced job openings. Indeed, Figure 1 shows that the share of announced posting and hires falls when C_a increases. This will in equilibrium lower the ratio of announced job openings to unemployed, which will cause the *perceived* matching efficiency to increase.

The same mechanism can be illustrated by gauging the movements in the perceived Beveridge curve. Indeed, Figure 2 shows how this curve shifts inwards in response to an increase in the relative cost of announced job openings. This is consistent with the increase in perceived matching efficiency illustrate in Table 2.

What is the takeaway from this simple numerical exercise? The introduction of two recruitment channels, one announced and one unannonced, opens for an additional channels through which the perceived matching efficiency can change. Indeed, we have shown that a change in the cost of posting announced job-openings (which in the standard model leads to movements along the Beveridge curve) in this augmented model can shift the perceived matching effiency and Beveridge curve. This illustrates the importance of accounting for the share of announced and unannounced job openings when annalysing the labor market. This will be the purpose in the sections below.

Table 2: Estimated matching function, $\log(h) = A + \alpha u + (1-\alpha)o$

λ	A	α	$1-\alpha$
With o = announced openings			
$C_a = 1.0$	0.69	.50	.50
$C_a = 1.2$	0.74	.50	.50
With o = total openings			
$C_a = 1.0$	0.34	.50	.50
$C_a = 1.2$	0.34	.50	.50

4 Concepts and measurements

- What is a job-openings?
- How is it measured?
  - Surveys
  - Administrative data

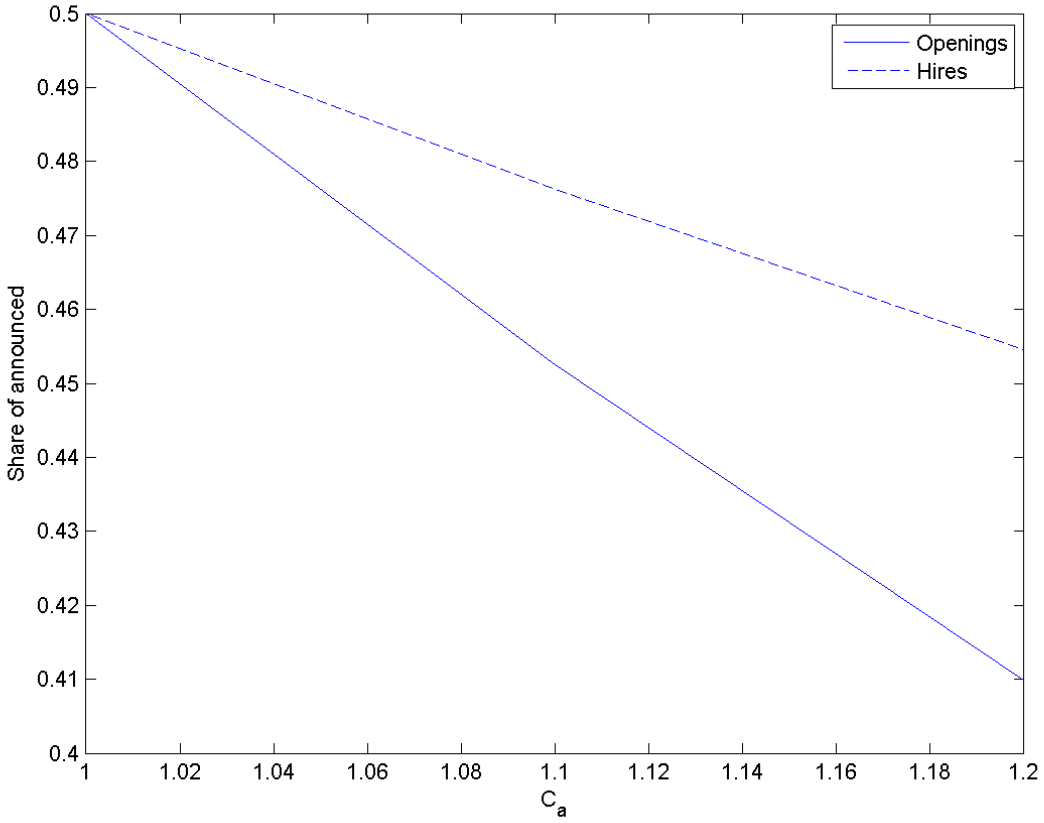

Figure 1: Shares of announced positions and hires as function of the cost of posting announced job openings.

5 Data Description

- Complete employment history from tax records
- Describe why and how data is collected, what we do to make series
- Describe full population data

6 Job Openings and Vacancies in Denmark 2004-2013

Present descriptives

- Simple time series
- Beveridge curve
- Variation by firm characteristics etc

7 Calibrating the Model

- Calibrate model

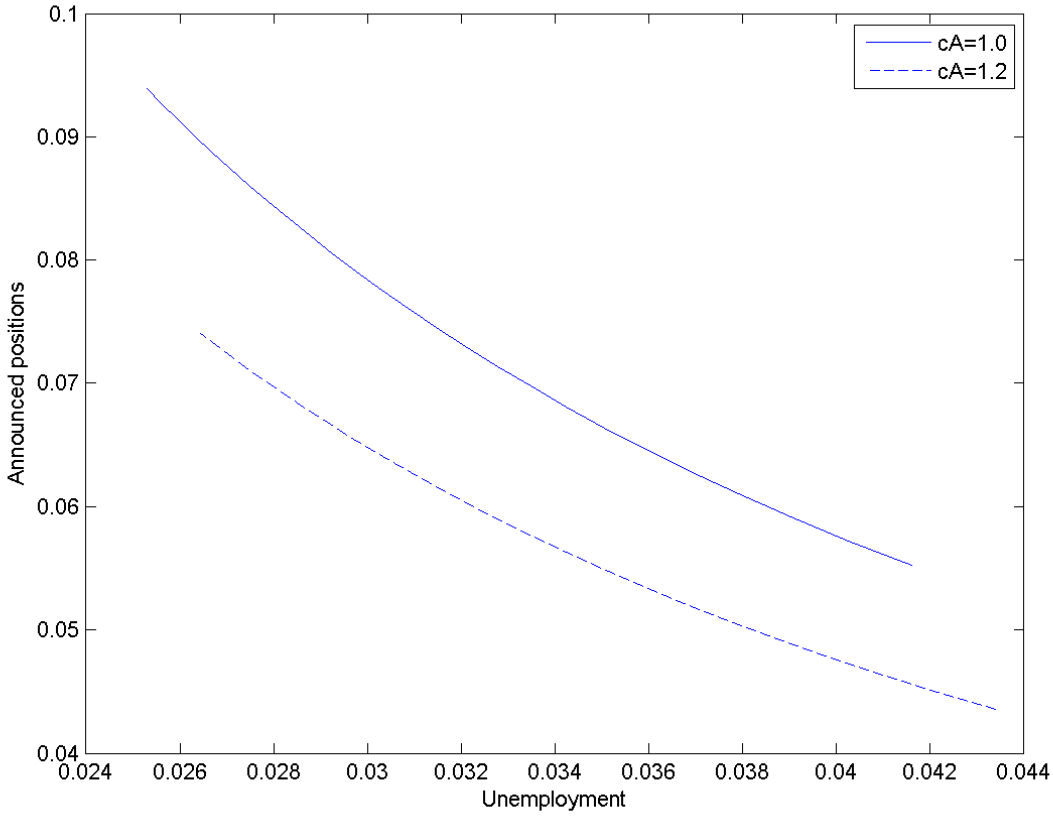

Figure 2: Perceived Beveridge Curve for two values of announcing job openings

8 Discussion and Conclusion

9 Appendix

Solution Algoritm

First note that (13) can be used to find a $\kappa(\theta)$

$$\kappa = \left(\frac{A_u/C_u}{A_a/C_a}\right)^{1/\alpha} \tag{16}$$

Then note that 13 also yields $w(\theta)$

$$w(\theta) = y - \frac{\theta^{\alpha}(r+q)}{A_a/C_a} \tag{17}$$

Using this along with (15) we can then find θ by solving this function numerically.

$$\frac{\beta}{1-\beta}\frac{y-w(\theta)}{r+q} = \frac{w(\theta)-z}{\theta m_A(\theta)+\kappa m_A(\kappa(\theta))+r+q} \tag{18}$$

This procedure yields solutions for θ, κ, w. By means of (12) we can then back out u.

Detailed description of data creation

Robustness of jobnet data

Bibliography