Problem Set 3 - Solution

Labour Economics, Winter Semester 2025/26

*Submit by Sunday, 4 January, 22:45h **on Moodle!***

Learning objectives

- Review concepts and facts regarding unemployment.
- Study and extend the standard model of job search.
- Evualate empirical approaches in terms of causally identifying mechanisms / parameters in this model.

Short questions:

Please indicate whether a statement is true or false. Provide a brief explanation for your answer.

1. The given Beveridge curve shows that the country of interest experienced an improvement of its labor market efficiency from 2007–2011 relative to 2001–2007.
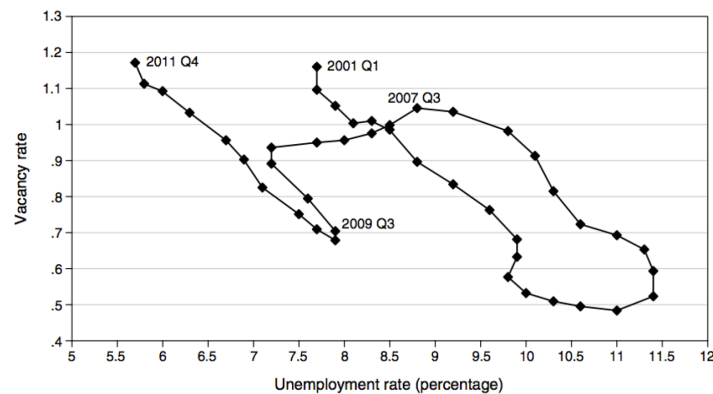
Solution

True. The Beveridge curve is a measure of a country's labor market efficiency. It relates a country's vacancy rate to its unemployment rate. The closer the curve to the origin, the higher its efficiency because, for example, the lower the vacancy rate at a given unemployment rate. Starting in Q1 of 2001, the given country's labor market efficiency first fell between 2001 and 2007 - there were more open jobs at a given unemployment rate than before. Between 2007-2011, the labor market became more efficient.

2. According to the baseline job search model discussed in class, an UI-induced increase in the reservation wage along with a boom in firms' demand for labor (i.e. a rise in the job offer arrival rate) will unambiguously lower the exit rate from unemployment.

   Solution

   False. The effect is ambiguous. The exit rate is defined as: $h = \lambda[1 - F(\phi)]$. On the one hand, an increase of the reservation wage will lower the exit rate from unemployment – as fewer wage offers exceed the individual's reservation wage. On the other hand, an increase in firms' demand for labor suggests an increase in λ - the job offer arrival rate - which should increase the exit rate from unemployment. Thus, effects go in opposite directions.

3. A spike in a country's unemployment rate during winter months is indicative of cyclical unemployment. It shall be cured by expansive fiscal policies.

   Solution

   False. It rather reflects seasonal patterns in labor demand. In some industries, e.g., agriculture or construction, production literally comes to a hold in winter, which results in the seasonal layoff of workers during this period.

Questions:

Consider a simple job search model, where unemployed individuals search for work under imperfect information. Individuals' intensity of search effort (e) has a direct, positive effect on the job offer arrival rate $\lambda(e)$ but also raises the costs of unemployment $\psi = \psi(e)$. Thus, the discounted utility of unemployment (rV_u) is given by:

$$rV_u = b - \psi(e) + \beta\lambda(e) \int_\phi^\infty [V^e(w) - V^u] F(w).$$

1. What's the interpretation of β in this value function? Provide intuition why an increase of this parameter may increase an individual's duration of unemployment.

   Solution

   Term β reflects the exogenous component in the job offer arrival rate. If the economy booms, more jobs will arrive irrespective of an individual's effort choice. Thus, individuals are predicted to raise their reservation in response. This may negatively affect the hazard rate. However, the higher reservation wage may be offset by the higher job offer arrival rate, too. Thus, while the duration of unemployment may increase in response to an increase in β, it does not necessarily have to be the case.

2. Assume the difference in the value of employment over the value of unemployment to be given as $V_e - V_u = \frac{w - rV^u}{r + q}$. Derive the level of the optimal reservation wage ϕ without using the two value functions V^e or V^u.

Solution

First, use the property that $\phi = rV^u$.

Second, re-arrange the value function as given above:

$$\phi = b - \psi(e) + \beta\lambda(e)\int_\phi^\infty [V^e(w) - V^u]F(w)$$

$$\phi = b - \psi(e) + \beta\lambda(e)\int_\phi^\infty [\frac{w - \phi}{r + q}]F(w)$$

$$\phi = b - \psi(e) + \frac{\beta\lambda(e)}{r + q}\int_\phi^\infty [w - \phi]F(w)$$

3. Now suppose that $\lambda(e) = \lambda e$, $\psi(e) = 0.5ke^2 + c_o$ and $\beta > 0$. Use the initial definition of the value function $rV^u = b - \psi(e) + \beta\lambda(e)\int_\phi^\infty [V^e(w) - V^u]F(w)$ to derive the optimal effort level.

Solution

$$\phi = b - (0.5ke^2 + c_o) + \beta\lambda e\int_\phi^\infty [V^e(w) - V^u]F(w)$$

$$d\phi/de = -ke + \beta\lambda\int_\phi^\infty [V^e(w) - V^u]F(w) = 0$$

$$e^* = \frac{\beta\lambda}{k}\int_\phi^\infty [V^e(w) - V^u]F(w)$$

4. Suppose the government introduces a minimum search requirement that enforces unemployed individuals to submit at least two applications per week. How does this policy affect the net income of job search in a given period in case the individual submitted 1 (3) applications per week before the policy reform (keeping all other factors constant)?

Solution

The net income of job search is given as $b - \psi(e)$. The policy reduces the net income in case an individual submitted one application per week before the policy reform. The policy does not affect the net income of individuals who submitted three applications before the reform.

5. In the U.S., the potential duration of unemployment benefit receipt differs across states. Using monthly state-level data on job applications from *careerbuilder.com* over the period from September 2007 to July 2011, Marinescu (2017, see Readings on Moodle) exploits the fact some states increased the potential benefit duration (PBD) at some point during this time period whereas others kept the parameter unchanged.

   a) To estimate causal effects, Marinsecu implements a difference-in-differences design. Verbally describe the empirical framework in one sentence. Second, illustrate why a

control group is needed at all. Third, state the key identifying assumption behind the authors' proposed difference-in-differences design.

Solution

Marinescu compares the pre- to post-reform evolution of individuals' job search behavior in U.S. states that saw a change in the PBD to the respective evolution of individuals' job search effort in states without a change in the PBD. A control group is needed to disentangle the true reform effect from any other effect that may have impacted job search behavior over time, such as macroeconomic trends. The design's underlying assumption is that absent treatment job search effort would have evolved similarly in treatment and control group states.

b) The graph below presents the paper's key result. How does an increase in the PBD affect job search effort? Interpret the treatment effect in terms of sign and significance. Moreover, indicate whether this result is in line with theory. If so, what does explain individuals' behavior? Last, assess the given pre trend. Does it support the causal interpretation of the estimated treatment effects?

Solution

The graph shows that an increase in the PBD reduces individuals' job search effort. The estimated effect builds up over the first four months, levels off thereafter and is statistically significant. The effect is in line with theory: an increase in the PBD increases the value of unemployment, which in turn lowers search effort. The pre–trend is a bit bumpy but overall flat and shows no clear pattern. Therefore, estimated treatment effects can be interpreted as causal.
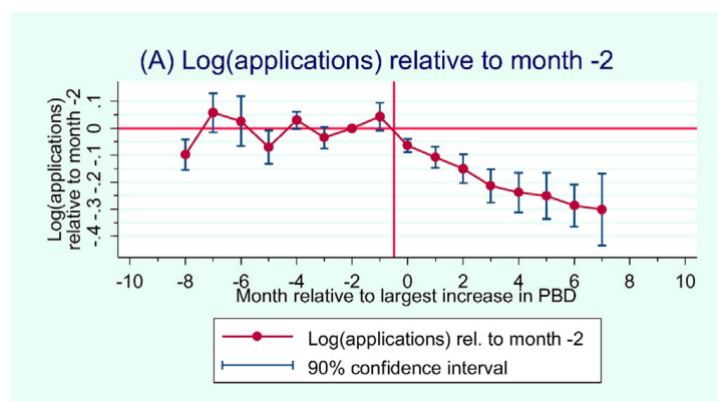
c) There is interest in estimating the causal effect of job search effort on unemployment duration. First, illustrate why a simple OLS regression of this relationship may lead to biased estimates. Second, assess whether we may use the PBD reforms as an instrument to derive causal effects. What properties does the instrument (the PBD reform) need to fulfill? Which condition may fail in the context of this study?

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Solution

The key concern when estimating the proposed model via OLS are omitted variables. Job search effort may be endogenous, e.g., because it may be correlated with intrinsic motivation, which may have a direct effect on the duration of unemployment irrespective of individuals' search effort. A suitable instrument needs to fulfill three properties: (i) it has to be correlated with the endogenous variable, (ii) uncorrelated with the error term, and (iii) have no other effect on the outcome of interest other than through the endogenous variable. The last assumption is likely violated. The PBD reform had an effect on effort but most likely also changed the reservation wage.

Readings:

Marinescu, Ioana. "The general equilibrium impacts of unemployment insurance: Evidence from a large online job board." Journal of Public Economics 150 (2017): 14-29.