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# The Reservation Wage Unemployment Duration Nexus \*

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## Abstract

A thorny problem in identifying the determinants of reservation wages and particularly the role of continued joblessness in their evolution is the simultaneity issue. We deploy a natural control function approach to the problem that involves conditioning elapsed duration on completed unemployment duration in the reservation wage equation. Our analysis confirms that the use of elapsed duration alone compounds two separate and opposing influences. Only with the inclusion of completed duration is the negative effect of continued joblessness on reservation wages apparent. For its part, the completed duration coefficient suggests that higher reservation wages negatively influence the probability of exiting unemployment.

KEYWORDS: reservation wages, unemployment duration, control function

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# 1 Introduction

In job search theory, the reservation wage is the lowest offered wage that an unemployed individual searching the market is prepared to accept. The notion of a reservation wage corresponds to the solution of a standard optimal stopping rule problem. Familiarly, and in general, higher reservation wages decrease the probability of reemployment and thus prolong the duration of unemployment.

The issue of whether the reservation wage is constant or declining over the spell of joblessness is of interest from the perspectives of theory, empirics, and policy. At the level of theory, there is an important distinction between constant and declining reservation wages. For its part, the constant reservation wage model lends itself to an accessible and parsimonious way of recouping the structural parameters of the optimal job search model (Lancaster and Chesher, 1983). Recognition of declining reservation wages, on the other hand, allows for a distinctly richer model and one that critically exploits the feedback mechanism running from unemployment duration to reservation wages (Kiefer and Neumann, 1979).

Empirically, the two models have very different structural content. The simple constant reservation wage model does not raise identification problems because the system of equations is triangular since by definition unemployment duration does not affect reservation wages. With declining reservation wages, however, an endogeneity problem arises because of the simultaneity between reservation wages and unemployment duration: that is to say, the reservation wage not only influences joblessness but it is also affected by unemployment duration.

Finally, from a policy perspective, reservation wages offer policy-makers an added margin of adjustment by allowing them to influence the shape of reservation wages over time. Thus, unemployment insurance (UI) rules can be manipulated, via changes in the replacement rate and/or maximum duration of entitlements, or by substituting social help for UI benefits proper, etc. In this way, policies have implications for nonstationary reservation wages.

Previous studies have rarely investigated reservation wages directly. Where

they have done so, the information in question has typically been collected as a snapshot, cross-section in form (Jones, 1988; Prasad, 2003; Sestito and Viviano, 2008). Accordingly, those analysts seeking to examine the course of reservation wages have used elapsed or incomplete unemployment duration as a regressor. But this method necessarily raises an issue of endogeneity, in the presence of which researchers have to had to rely on a somewhat fragile instrumental variables approach.

However, if one has the good fortune to possess longitudinal data with repeated observations on reservation wages, information on completed unemployment duration can be used to great advantage; specifically, as an argument of the control function used to construct a consistent estimator of the rate of decline in reservation wages. In short, being able to condition on completed duration enables one to derive the impact of elapsed duration on reservation wages.

The intuition behind the trick used here is straightforward. A naive regression of reservation wages on elapsed unemployment duration is dogged by reverse causality precisely because higher reservation wages will generate longer completed durations (and, by implication, longer completed durations entail longer elapsed durations). The trick is, then, to include both elapsed and completed duration in the set of regressors. Interestingly, this technique shares commonalities with the tenure-earnings literature, where better matches produce higher earnings and longer lasting jobs, and where analogously information on completed job duration is required to obtain a consistent estimate of the impact of current tenure on wages (see Abraham and Farber, 1987).

The intention of the present treatment is simply to offer a revealing illustration of how to tackle endogeneity in an important contemporary applied economics setting.

## **2 The estimation approach**

Let  $W$  denote the reservation wage,  $Z$  a vector of observed exogenous variables (individual and calendar effects),  $U$  the elapsed duration of stay in the state of un-

employment (backward recurrence time), and  $\epsilon$  explanatory unobserved variables.  $V$  will represent remaining duration of stay in the state of unemployment (forward recurrence time), so that a complete unemployment spell will have duration  $S = U + V$ .

We want to identify the partial effect

$$\partial E[W|Z, U]/\partial U,$$

measuring the effect of an increase in elapsed unemployment duration on the average reservation wage of individuals with observed attributes  $Z$ . A naive approach would be to estimate

$$W = \alpha'Z + \beta U + \epsilon.$$

The reverse causation arguments presented above suggest that  $U$  is endogenous in the sense that  $E[\epsilon|Z, U] = E[\epsilon|U] \neq 0$ . Therefore, the coefficient  $\beta$  will not capture the desired partial effect of  $U$ .

A simple way of formalizing the endogeneity of the elapsed duration is to assume the extra equation

$$U = \gamma'Z + \delta V + \omega$$

and the restrictions

$$E[\omega|Z, V] = 0 \quad \text{and} \quad E[\epsilon|Z, V, \omega] = E[\epsilon|\omega] \neq 0.$$

(See Heckman and Robb, 1985; Newey, Powell, and Vella, 1999; Matzkin, 2004.)

In this model, the parameter of interest becomes,

$$\partial E[W|Z, U]/\partial U = \beta + \partial E[\epsilon|\omega]/\partial U.$$

Some remarks are in order.

1. The first moment restriction states the exogeneity of  $Z$  and  $V$  for  $U$  and the second establishes that the correlation between  $W$  and  $U$  rests on unobservables.

2. The second equation together with the moment restrictions characterizes the endogeneity of  $U$  for  $W$ . As explained in the introduction, for given  $U$ , higher reservation wages induce higher continuing durations (an implication of basic job search theory) which, being correlated with elapsed durations, establish the reverse causation mechanism.
3.  $U$  and  $V$  are, in general, statistically dependent (Lancaster, 1990, 94). The correlation between these variables is typically positive, for exactly the same reasons that hazard functions of unemployment usually exhibit negative duration dependence: due to neglected heterogeneity individuals with long elapsed durations tend to have longer complete unemployment spells. The exception occurs when the unemployment duration distribution of the flow of entrants into unemployment is exponential (conditional on  $Z$ ). Then  $\delta = 0$ .
4. If  $E[\epsilon|\omega] \neq 0$ , the OLS estimation of the reservation wage equation yields an inconsistent estimator of  $\beta$  (even if  $\delta = 0$ ).

Now suppose that, as suggested in the introduction, we also condition on  $S$ , the complete duration, (or, equivalently, on  $V$ )

$$\begin{aligned}
E[W|Z, U, V] &= \alpha'Z + \beta U + E[\epsilon|\omega] \\
&= \alpha'Z + \beta U + CF(\omega) \\
&= \alpha'Z + \beta U + CF(U - \gamma'Z - \delta V)
\end{aligned}$$

for some function  $CF(\cdot)$ , the so-called control function (Heckman and Robb, 1985).

Assume, for simplicity and illustrative purposes, that  $CF(\cdot)$  is linear (as would be the case if  $(\epsilon, \omega)$  were jointly normally distributed), that is  $CF(\omega) = \lambda\omega$ , we may write (substituting  $V = S - U$ ),

$$\begin{aligned}
E[W|Z, U, V] &= \alpha'Z + \beta U + \lambda(U - \gamma'Z - \delta(S - U)) \\
&= \tilde{\alpha}'Z + \tilde{\beta}U + \tilde{\delta}S,
\end{aligned}$$

where the  $(\tilde{\cdot})$  denotes obvious transformations of the original parameters. This regression can be estimated by OLS. The partial effect of elapsed duration on the

reservation wage is given by  $\tilde{\beta} = \beta + \lambda(1 + \delta)$ .<sup>1</sup> Of course, assuming a linear control function is unduly restrictive. A standard RESET test may be used to gauge the significance of this misspecification. A more general alternative will entail some form of power-series approximation to the control function.

### 3 Data

Our data are taken from the first six waves of the European Community Household Panel (EHCP), 1994-99. The ECHP is a survey based on a standardized questionnaire administered annually to a representative panel of households and individuals in 15 EU member states and offers detailed information on the respondent's labor market experience, inter al. (see EUROSTAT, 1999). We used data for 13 of the countries, excluding Luxembourg and Sweden, where it is not possible to follow individuals through time.<sup>2</sup>

The key pieces of information taken from the survey are reservation wages and elapsed duration. In the EHCP each individual actively looking for work is asked two questions pertaining first to desired hours of work and second to the minimum income required to work these hours. The actual questions asked are these: *Assuming you could find regular work, how many hours would you prefer to work in this new job?* and *What is the minimum net monthly income you would accept to work [these number of] hours a week in this new job?* We construct an hourly net reservation wage, computed as the ratio of desired net monthly income to the optimal number of hours. This variable is deflated by the respective national consumer price index.

The other crucial variables are the duration of the current unemployment spell and its ultimate duration. The ECHP sampling procedure considers only jobless spells of individuals with previous work experience for whom we are able to identify

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<sup>1</sup>A simple (but rather telling) alternative specification, and one that avoids by construction the endogeneity of unemployment duration, would be to use the ratio between elapsed and completed unemployment duration as a regressor. Estimation of this model generated a negative and statistically significant coefficient for the ratio variable.

<sup>2</sup>The countries are Austria, Belgium, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Portugal, Spain, The Netherlands, and the United Kingdom.



the onset of unemployment by month and year. Given that, with one exception, we know the month and year of the interview we compute elapsed duration as the period from the point of job loss up to the interview. (That one exception is Germany, for which country we assume that all the interviews were conducted in October.) As far as completed duration is concerned, since we can follow the individual between surveys up to the point of reemployment, we can simply add the residual calendar months spent unemployed in the subsequent interval to compute elapsed duration.

In the present exercise, we were interested in using most the parsimonious model consistent with a declining reservation wages. Accordingly, the RHS arguments additional to elapsed and completed duration were limited simply to a gender dummy, three schooling dummies, four age dummies, five time dummies, and thirteen country dummies. We also deployed a continuous measure of the overall unemployment rate at the time of the survey.<sup>3</sup>

## 4 Findings

Summary results of fitting the reservation model separately for elapsed duration and completed duration are given in the first two columns of Table 1. The elasticity of reservation wages with respect to elapsed duration is negative but statistically insignificant at conventional levels. The point estimate is tiny, suggesting that a 1 percent increase in the duration of an ongoing spell is associated with a 0.002 percent decrease in reservation wages. For its part, the elasticity of the reservation wage with respect to completed duration is positive but again small in magnitude (0.004) and statistically insignificant as well.

However, as is apparent from the penultimate column of the table, when both duration variables are included in the reservation wage equation, each is statistically significant. And indeed each elasticity is sharply higher:  $-.015$  and  $.024$ , respectively. Conditioning on completed duration, then, there is every indication

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<sup>3</sup>We also experimented using a variable identifying the order of distinct unemployment spells as well as the receipt (or otherwise) of unemployment insurance benefits. In neither case, however, were the results reported below disturbed by their inclusion.

of a small but nontrivial and well-determined decline in reservation wages over the course of joblessness. The positive association between completed duration and reservation wages is of course indicative of the reverse line of causation running from reservation wages to jobless duration.

As noted above, the specifications in Table 1 include 13 country dummies. If, however, country heterogeneity may be expected to assist in the identification of the impact of unemployment duration on reservation wages, we might usefully drop the country dummies. In the final column of the table, therefore, we provide results for the correct specification, including both duration measures but omitting the country fixed effects. Compared with the results in the preceding column, it can be seen that the point estimates for the duration measures strengthen in absolute magnitude.

Variable	Specification			
	(1)	(2)	(3)	(4)
U	-0.002 (0.002)		-0.015 (0.004)	-0.025 (0.005)
S		0.004 (0.004)	0.024 (0.006)	0.070 (0.007)
Country dummies	Yes	Yes	Yes	No
$R^2$	0.418	0.418	0.419	0.166
number of observations	10003	10003	10003	10003

Table 1: THE DETERMINANTS OF RESERVATION WAGES. ROBUST STANDARD ERRORS IN PARENTHESIS. THE REGRESSIONS ALSO INCLUDE A CONTINUOUS UNEMPLOYMENT RATE VARIABLE, A GENDER DUMMY, 3 SCHOOLING, 4 AGE, AND 5 YEAR DUMMIES.

As a robustness check, we re-ran the preferred reservation wage equation by gender, with and without country dummies. The summary results are given in Table 2. We see that, conditioning on completed duration, reservation wages are decreasing in ongoing joblessness for both males and females. The results are however stronger, in terms of both absolute magnitude and statistical significance for males, as indeed is the reverse line of causation running from reservation wage to unemployment duration. On this occasion, however, removing the country

dummies yielded almost identical point estimates by gender.

Variable	Males		Females	
U	-0.020 (0.006)	-0.025 (0.007)	-0.009 (0.005)	-0.024 (0.006)
S	0.031 (0.010)	0.071 (0.011)	0.016 (0.008)	0.071 (0.010)
Country dummies	Yes	No	Yes	No
$R^2$	0.371	0.154	0.468	0.155
number of observations	5181	5181	4822	4822

Table 2: THE DETERMINANTS OF RESERVATION WAGES BY GENDER. ROBUST STANDARD ERRORS IN PARENTHESIS. THE REGRESSIONS ALSO INCLUDE A CONTINUOUS UNEMPLOYMENT RATE VARIABLE, A GENDER DUMMY, 3 SCHOOLING, 4 AGE, AND 5 YEAR DUMMIES.

## 5 Conclusions

The fact that reservation wages and unemployment duration are simultaneously determined has preoccupied analysts in this area and arguably would have proven more disruptive had direct information on reservation wages been more readily available. In the present treatment, we have been able to exploit such information to demonstrate how the true effect of the unemployment experience on reservation wages can be modeled. The approach which is to condition elapsed duration on completed duration is analogous to that used by Abraham and Farber (1987) in addressing the bias attaching to the pro-productive tenure argument in the augmented Mincerian earnings function, which we have formally approached as an omitted variables problem. We have shown that reservation wages are declining over the course of the unemployment or jobless spell. While rejecting the assumption of stationary reservation wages, we note that the elasticity/elasticities of reservation wage with respect to elapsed duration are rather small and, further, that there is well-determined direct association between completed duration and reservation wages which is to be construed as higher reservation wages lead to higher jobless duration. By failing to control for completed jobless duration we

conflate the two opposing effects.

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