

The Reservation Wage Unemployment Duration Nexus*

JOHN T. ADDISON[†], JOSÉ A. F. MACHADO[‡], and PEDRO PORTUGAL[§]

[†]*Department of Economics, Moore School of Business, University of South Carolina, 1705 College Street, Columbia, SC 29208, USA.*

(email: ecceaddi@moore.sc.edu)

[‡]*NOVA School of Business and Economics, Lisboa, Portugal.*

(email: jafm@novasbe.pt)

[§]*Banco de Portugal and NOVA School of Business and Economics. Lisboa, Portugal.*

(email: pportugal@bportugal.pt)

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 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.

JEL classification numbers: J64, J65

Keywords: reservation wages, unemployment duration, control function

*The authors are especially indebted to an anonymous referee for helpful comments on earlier drafts of this paper.

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. Under fairly general conditions, it can be shown that the reservation wage is a function of net search costs, the arrival rate of job offers, and the wage offer distribution. Familiarly, and in general, higher reservation wages decrease the probability of reemployment and thus prolong the duration of unemployment. The primary exogenous driver here would be an improved generosity of unemployment insurance benefits.

But there is a potential simultaneity issue, the nature of which is aptly described in Lancaster (1985: 113-114). The setting is one in which an unemployed person selects a sequence of reservation wages as a deterministic, decreasing function of time, receives random wage offers, and stops searching on the first occasion on which a wage offer exceeding the reservation wage is encountered. Lancaster notes that were we to randomly sample the population of such individuals and observe their reservation wage, W , and elapsed search duration, U , we might reasonably conclude that an individual searcher jobless for an extended period is likely to have been using a relatively high reservation wage. However, given that the reservation declines over time, the implication is that the longer the interval of joblessness, the lower the individual's reservation wage must be. In other words, '... there are two causal relationships between W and U in one of which W is a deterministic function of the date and in the other the elapsed duration of unemployment is a (stochastic) function of W . The U we observe is both the date and a realization of the random elapsed duration ...'.¹

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

¹Lancaster further argues that there will be two causal relationships between the accepted wage and completed duration S (as opposed to elapsed duration U) since the offered wage is an increasing function of the reservation wage. Note that we are here replacing Lancaster's symbols for the reservation wage and elapsed/completed durations of unemployment with those used in the present paper.

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; Lancaster, 1985).

Empirically, the two models have very different structural content. The simple constant reservation wage model does not raise identification problems because by definition unemployment duration does not affect reservation wages. But reservation wages could change over time for a variety of reasons, including the termination/diminution of unemployment insurance benefits, the exhaustion of financial assets, the depreciation of human capital, or stigmatization by employers. With declining reservation wages, as we have seen, 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.

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

Previous studies have rarely investigated the relationship between reservation wages and unemployment duration 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 in this set-up elapsed duration is influenced by expected completed duration (stock sampling plan), forcing

analysts to rely on potentially invalid instruments.

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, namely as an argument of the control function used to construct a consistent estimator of the rate of decline in reservation wages. In other words, being able to condition on completed duration enables one to divine the impact of elapsed duration on reservation wages.

The intuition behind the ‘trick’ used here is straightforward. A 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).

In short, our intention is to offer a practical means of establishing whether reservation wage do indeed decline over the course of joblessness.

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 unemployment. The completed unemployment spell will have duration denoted by S . Our approach is motivated by the existence of sample information for both U and S . The set-up borrows from Matzkin (2004) for the econometrics and from Lancaster (1985) for the economic rationale.

We want to identify the function m in the model

$$W = m(U, Z, \epsilon), \tag{1}$$

where m is an unknown function that is strictly increasing in ϵ , and ϵ represents explanatory unobserved variables. (ϵ may be dubbed the ‘propensity to search’.) More modestly, we may just be interested in identifying the average partial effect

$$E\{\partial m(U, Z, \epsilon)/\partial U\}, \quad (2)$$

measuring the effect of an increase in elapsed unemployment duration on the average reservation wage.

The identification problem stems from the likely endogeneity of U , as pointed out by Lancaster (1985). The argument runs as follows. Even when the reservation wage is a decreasing function of time, a sampled long elapsed duration may indicate high propensity to search and, consequently, a high W vs U ‘schedule’. In other words, higher reservation wages induce higher continuing and hence completed durations (an implication of basic job search theory) which, in turn, are correlated with elapsed durations.

The key identifying assumption is that, conditional on the complete duration S , U and ϵ are independent (given Z). This assumption seems quite likely to be met. Indeed, by controlling for S , one controls for the individual unobserved heterogeneity (propensity to search) that accounts for the reverse causation from W to U .

Matzkin (2004) shows that the identification condition is equivalent to the existence of a function (‘control function’) r and a random variable η independent of U such that $\epsilon = r(S, \eta)$. We may thus write $W = m(U, Z, r(S, \eta))$.

The argument is easier to follow focusing on the mean estimation of separable models

$$W = m(U, Z) + \epsilon, \quad (3)$$

with $E[\epsilon|U, Z] = E[\epsilon|U] \neq 0$. The identifying assumption becomes

$$E[\epsilon|U, S, Z] = E[\epsilon|S] = c(S) \quad (4)$$

for some function c , the control function. Then,

$$E[W|U, S, Z] = m(U, Z) + c(S), \quad (5)$$

which for known c enables the identification of m .

For linear m and c

$$E[W|Z, U, V] = \alpha'Z + \beta U + \delta S, \tag{6}$$

which can be estimated by OLS. Linearity would be a natural first approximation. A much cleverer justification would be to rely on the distributional assumptions regarding the wage offer distribution itself. This is indeed the approach proposed by Lancaster (1985), who shows that under either Pareto or Lognormal forms for the wage offer distribution, one can derive a conventional system of (two) simultaneous linear equations. By virtue of this simple form, the identification issues and the linear restrictions needed to identify the structural parameters are rendered transparent. In general c will not be linear (it would be so were (ϵ, S) jointly normally distributed). 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 as in, for instance, Newey, Powell and Vella (1999).

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.²

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

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

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 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.

Omitted variable bias is always an issue in the estimation of these models. By including completed unemployment duration as a regressor we hope to partially account for *unobserved* individual heterogeneity. This is because individuals whose unobserved (to the researcher) characteristics that make them less employable are more likely to stay unemployed.

In the present exercise, in addition to elapsed and completed duration, the RHS arguments comprise a gender dummy, three schooling dummies, four age dummies, five time dummies, thirteen country dummies, together with a continuous measure of the overall unemployment rate at the time of the survey.³ Table 1 provides descriptive statistics for the main arguments.

³We 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.

TABLE 1
Descriptive statistics

<i>Variable</i>	<i>Males</i>		<i>Females</i>	
	Mean	Std. dev.	Mean	Std. dev.
Reservation wage (in logs)	1.156	0.378	1.411	0.378
Elapsed unemployment duration (in logs)	2.583	1.376	2.883	1.395
Completed unemployment duration (in logs)	3.345	0.834	3.341	0.902
Unemployment rate	12.513	4.370	11.819	4.423
Basic education	0.534		0.411	
Secondary education	0.313		0.378	
Tertiary education	0.133		0.174	
Age dummies				
17-25	0.379		0.425	
26-35	0.296		0.307	
36-45	0.177		0.186	
46-55	0.124		0.076	
Number of observations	5181		4822	

Source: European Community Household Panel.

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 2. 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 of a small but nontrivial and well-determined decline in reservation wages over the course of joblessness. The positive association between completed duration and

TABLE 2
The determinants of reservation wages

<i>Variable</i>	<i>Specification</i>			
	(1)	(2)	(3)	(4)
Elapsed duration, U	-0.002 (0.002)		-0.015 (0.004)	-0.025 (0.005)
Completed duration, 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

Notes: 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.

Source: European Community Household Panel.

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 thirteen 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.⁴

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

⁴As a robustness check, we re-ran the reservation wage equation by gender.

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 elasticities of reservation wage with respect to elapsed duration are rather small. By failing to control for completed jobless duration we conflate the two opposing effects.

References

- Abraham, K.T. and Farber, H.S. (1987). 'Job duration, seniority, and earnings', *American Economic Review*, Vol. 77, pp. 278-297.
- Addison, J.T., Centeno, M. and Portugal, P. (2004). 'Reservation wages, search duration, and accepted wages in Europe', IZA Discussion Paper No. 1252, Institute for the Study of Labor, Bonn.
- Heckman, J. and Robb, R. (1985). 'Using longitudinal data to estimate age, period, and cohort effects in earnings equations', in Mason, W.M. and Feinberg, S.E. (eds), *Cohort Analysis in Social Research: Beyond the Identification Problem*, Springer Verlag, New York, pp. 137-150.
- European Commission (EUROSTAT). (1999). 'European Community Household Panel. Longitudinal Users' Database'. Waves 1,2, and 3. Manual, EUROSTAT, Luxembourg.
- Kiefer, N.M. and Neumann, G.R. (1979). 'An empirical job-search model with a test of the constant reservation wage hypothesis', *Journal of Political Economy*, Vol. 87, pp. 89-107.
- Jones, S. (1988). 'The relationship between unemployment spells and reservation wages as a test of search theory', *Quarterly Journal of Economics*, Vol. 103, pp. 741-765.
- Lancaster, T. (1985). 'Simultaneous equations models in applied search theory', *Journal of Econometrics*, Vol. 28, pp. 113-126.
- Lancaster, T. (1990). *The Econometric Analysis of Transition Data*, University Press, Cambridge.
- Lancaster, T. and Chesher A. (1983). 'An econometric analysis of reservation wages', *Econometrica* Vol. 51, pp. 661-1676.
- Matzkin, R. L. (2004). 'Unobservable instruments', unpublished paper, Northwestern University.

Newey, W.K., Powell, J.L. and Vella, F. (1999). 'Nonparametric estimation of triangular simultaneous equation models', *Econometrica*, Vol. 67, pp. 565-603.

Prasad, E. (2003). 'What determines the reservation wages of unemployed workers? New evidence from German micro data', IZA Discussion Paper No. 694, Institute for the Study of Labor, Bonn.

Sestito, P. and Viviano E. (2008). 'Reservation wages: explaining some puzzling regional patterns,' Working Paper No. 096, Bank of Italy, Rome.

Appendix A: Gender differences

Table A1 provides summary reservation wage regressions by gender. Observe that, conditioning on completed duration, reservation wages are again decreasing in ongoing joblessness. But the results are stronger in both absolute magnitude and statistical significance for males, as indeed is the reverse line of causation running from reservation wages to employment duration. That said, removing the country dummies yields almost identical point estimates by gender.

TABLE A1
The determinants of reservation wages by gender

<i>Variable</i>	<i>Males</i>		<i>Females</i>	
Elapsed duration U	-0.020 (0.006)	-0.025 (0.007)	-0.009 (0.005)	-0.024 (0.006)
Completed duration 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

Notes: 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.

Source: European Community Household Panel.