The Effects of State Dependence in University Graduates Employment: Analysis Using Dynamic Model

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Abstract: This paper examines the causal relationship that exists between an individual's unemployment experience and his or her future employment prospects. In the literature, such a relationship is termed state dependence. The data of the present study come from a survey addressed to a representative sample of Moroccan graduates from 3 universities covering all their faculties and schools. A dynamic random effects probit model is estimated to test for state dependence effects in Active Moroccan University Graduates. In this model, an individual's employment probability at a giving point in time, during the period between leaving the University and three years after, is primarily dependent on his labour force status in the previous period. The level of higher education and qualifications have also a significant influence on the probability of holding down a job. After controlling both for observed and unobserved population heterogeneity, results strongly suggest that past unemployment decrease individual's chances of current employment, validating the "scar theory" of unemployment, which stipulates that a previous unemployment spell precludes the accumulation of work experience and may bring the deterioration of human capital.

Keywords: Labor Market; Dynamic random effects probit model; Panel data.

1. Introduction

The idea that, there is a causal relationship between an individual's past employment or unemployment and his future labour force status, is of considerable interest in the theory of unemployment. Furthermore, the 'scar theory' of unemployment holds "that unemployment experience alters one's future probability of being unemployed because individuals lose valuable work experience while they are unemployed, or because they are marked as 'losers' by potential employers" (Heckman / Borjas 1980, p. 250).

Moreover, in the literature, we suggest that an individual who has experienced an unemployment spell is more likely to be also observed unemployed in the future than someone who has never been unemployed.

To explain graduates' labour force behaviour during the period between leaving the University and three years after, we estimate a dynamic random-effects probit model and test for state dependence effects with respect to individual's labour force status in the previous period.

After controlling for observed and unobserved population heterogeneity, results show that there are strong state dependence effects in individual unemployment dynamics.

The remainder of the paper proceeds as follows. The econometric model is set out in section 1 and the data are presented in section 2. The main results of the paper are contained in section 3.

2. Econometric Specification

In this section, we present the dynamic probit model used to analyze the effects of employment and unemployment experience of Moroccan University Graduates on the probability of finding a future job. The model includes the previous state among the explanatory variables to allow for state dependence. The treatment of unobserved heterogeneity and the initial conditions is an important problem.

2.1. A dynamic random effects probit model

In our model y_{it}^* depends on a vector x_{it} of measured exogenous variables, on the employment status in the previous period y_{it-1} and on the error term ε_{it}.

The latent equation for the random effects dynamic probit model to be considered is specified as:
$$y_{it}^* = \gamma y_{it-1} + \beta' x_{it} + \alpha_i + \varepsilon_{it}$$

(i = 1, . . . , N; t = 2, . . . , T), the subscript i indexes individuals and t time periods. y_{it}^* is the latent dependent variable for individual i in period t describing an individual's employment propensity, x_{it} is a vector of exogenous explanatory variables, α_i are (unobserved) individual-specific random effects, and the ε_{it} are assumed to be distributed N(0, ε_{it}).
The observed binary outcome variable y_{it} is defined as:

$$y_{it} = \begin{cases} 1 & si \ \ y_{it}^* = \gamma y_{it-1} + \beta' x_{it} + \alpha_i + \varepsilon_{it} > 0 \\ 0 & si \ \ y_{it}^* \leq 0 \end{cases}$$

The presence of the lagged outcome variable y_{it-1} allows us to test the hypothesis of true state dependence. However, the error term may be serially correlated, for a given individual, which would lead to spurious state dependence. Therefore, in order to test for true state dependence we have to control for unobserved individual effect.

2.2 Heckman's estimator

The following dynamic reduced form model is specified:
$$Prob[y_{it} = 1 | y_{it-1}, \mathrm{x}_{it}, \alpha_i] = \Phi[\gamma \mathrm{y}_{it-1} + \mathrm{x}'_{it}\beta + \alpha_i] \quad i=1,\ldots,N \quad (1)$$

Heckman (1981b) proposed the approach to the initial conditions problem that involves specifying a linearized reduced form equation for the initial period:
$$\mathrm{Prob}[\mathrm{y}_{i1} = 1 | \alpha_i] = \Phi[\mathrm{z}'_i\lambda + \theta\alpha_i] \quad i=1,\ldots,N \quad (2)$$

Where Z_{i1} includes x_{i1} and exogenous instruments. The likelihood function for a random sample is then:
$$L_i = \int \left(\phi[(z'_{i1}\lambda + \theta\alpha_i)(2y_{i1} - 1)] \prod_{t=2}^{T_i} \phi[(x'_{it}\beta + \gamma y_{it-1} + \alpha_i)(2y_{it} - 1)] \right) g(\alpha_i) d\alpha_i \qquad (3)$$
Where g(α) is the density probability function of unobserved heterogeneity specific to individuals, and in this case standard, α is taken to be normally distributed and the integral given in this last equation can be calculated using Gaussian—Hermite quadrature (Butler and Moffitt, 1982).

2.3 Wooldridge's CML estimator

In contrary to Heckman who approximates the joint probability of the full-observed y sequence, Wooldridge (2005) has proposed an alternative Conditional Maximum Likelihood (CML) estimator that

considers the distribution conditional on the initial period value (and exogenous variables). Wooldridge suggests modelling the density of $(y_{i2}...y_{iT})$ conditional on (y_{i1}, x_i).
Specifying a model for yi1 given xi and αi is replaced by specifying one for αi given y_{i1} and x_i. The model for αi is specified in its simplest form as:

$$\alpha_i = \xi_0 + \xi_1 y_{i1} + z_i{'}\xi + a_i \quad (4)$$

Substituting into equation (1) gives:

$$Prob[y_{it} = 1 \backslash y_{it-1}, x_{it}, \alpha_i] = \Phi(x'_{ij}\beta + \gamma y_{it-1} + \xi_0 + \xi_1 y_{i1} + z_i\xi + a_i) \quad t=2,\dots,Ti \quad (5)$$

3. Description of the Data

The data of the present study come from a survey[1] addressed to a representative sample of graduates from 3 universities covering all their faculties and schools. This survey is based on a three-year monthly retrospective calendar, and it aims to collect new data about occupational integration of young graduates. The dependent variable used is the employment status of the individual i at time t, aggregated into the categories 'employed' and 'non-employed'.

We first estimated a general specification of the random effects probit model by including a number of explanatory variables.

The set of explanatory variables in the structural probit equation includes personal characteristics (age) and the level of higher education and qualifications (graduate degree).

4. First Empirical results

The model include, as discussed previously, the usual set of control variables such as family variables (age) and level of education. The state dependence effect is accounted for by the inclusion of the previous labour market status variable, with the allowance for unobservable individual characteristics in the model.

From the estimation results for the dynamic random effects probit model, we conclude that younger individuals have better chances of getting a job. Concerning educational qualification variable, it is estimated that an individual with an engineering degree would be more likely to have a job. Having an engineering degree increases the probability of employment to about 2.6%. This figure decreases to 2% if the individual possess doctoral degree.

Furthermore, an individual's current employment status is strongly dependent on his state in the previous period. The employment probability for a young who has been employed at the previous period increases by 85 percent in the Wooldridge specification. That is, once the individual experience an unemployment spell, he is really scarred by his experience.

[1] National Authority of Evaluation of the Educational System

Table 1: Dynamic Simple Probit Model results for Graduates Employment Behaviour

Variables	Probit /random effects	Wooldridge estimator
Lagged dependent variable (Yt-1)	0.928*** (0.000)	0.879*** (0.000)
Initial conditions	-	0.038*** (0.000)
Age	-0.022*** (0.000)	-0.021* (0.000)
Age square	0.0004*** (0.000)	0.0003* (0.000)
Graduate degree :		
Licence	Ref.	Ref.
Master	0. 028*** (0.000)	0.027*** (0.000)
Engineering degree	0.046*** (0.000)	0.040*** (0.000)
Doctoral degree	0.028*** (0.000)	0.025*** (0.000)
Unobserved heterogeneity	0.074	1.29 e-06
Number of observations	21951	21951
Log likelihood	-1431.441	-1419.569
Wald	6748.98*** (0.000)	5656.37*** (0.000)

Source: Author's calculation (wave 2009 of graduates from 3 universities)
NB: The table presents marginal effects and standards deviation in brackets. ***, **, * indicate thresholds of significance respectively of 1%, 5% et 10%

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