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An econometric model of birth inputs and outputs for Native Americans

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Abstract

This paper presents a new model of the birth process of Native Americans with seven endogenous variables: four birth inputs *maternal smoking* (S), *drinking* (D), *prenatal care* (PC), and *weight gain* (WG), and three birth outputs *gestational age* (G), *birth length* (BL), and *birth weight* (BW). The model is a seven-equation simultaneous model with three endogenous dummies S, D, and PC. The data are taken from the National Longitudinal Survey of Youth (NLSY). We find that the four birth inputs are determined jointly and dependently among S, D, and PC, but independently of WG. S has negative systematic correlation with G. D and PC appear to have no sizeable systematic effect on G, BL, or BW. Except for the sizeable and positive correlation between the unexplained parts of S and G, there seem to be no unexplained common effects between the birth inputs and outputs. Moreover, G appears dependent on the exogenous size of the mother. BL is affected by the inputs mainly through WG. BW is affected by the inputs through their effects on G. Except for maternal weight, there is little correlation between the remaining exogenous variables and BW. Finally, the predictive density of BW for a typical pregnancy gives a mean weight of 3.240 kg.

JEL classification: C11; C34; I12; J13

Keywords: Bayesian; Birth length; Birth weight; Drinking; Gestation; Prenatal care; Simultaneity; Smoking; Weight gain

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1. Introduction

This paper is the first of a series by us (Li and Poirier, 2000, 2001a, b, 2002) analyzing *birth weight* (*BW*) and related birth outcomes. The model has its origins in Poirier (1998) and we extend the estimation procedures discussed in Chib and Greenberg (1998) and Li (1996, 1998).

BW is probably the single most important indicator of infant health (Institute of Health, 1985). It is also a significant predictor of infant mortality, morbidity, coronary heart disease, and learning disabilities later in life (Poirier, 1998). The vast majority of studies on BW, particularly in the biomedical literature are single-equation models that ignore the simultaneity issues, a notable exception is Permutt and Hebel (1989). An important contribution of this study is to address the simultaneity issue head on.

Our new model for the birth process is a nonlinear simultaneous equations model with the following features: (1) triangular coefficients of endogenous variables matrix, (2) mixed unlimited and limited (dichotomous) dependent variables, (3) zero restrictions on elements of both coefficients of endogenous variables matrix and coefficients of exogenous variables matrix, and (4) normal residuals. Existing work with a Bayesian orientation sharing some of these features are Chib and Greenberg (1998) and Li (1996, 1998). Chib and Greenberg (1998) concerns multivariate probit models. As in Chib and Greenberg (1998), diagonal elements of the variance–covariance matrix corresponding to dichotomous dependent variables are restricted to be unity and the Metropolis update (Chib and Greenberg, 1995) we take in this paper for each block of the variance–covariance matrix is essentially the same as Chib and Greenberg (1998). The model in Li (1996, 1998) has features of (1) and (4), and limited dependent variables (mixed dichotomous and censored).

The paper proceeds as follows. In Section 2 we introduce the data. In Section 3 we discuss our modeling framework and the prior distribution. We present computational details in Section 4 and report empirical results in Section 5. Some concluding remarks are offered in Section 6.

2. Data

The data we explore is the National Longitudinal Survey of Youth (NLSY). We focus on the experience of Native American women in the NLSY when they became mothers and on the birth of their children. We choose to analyze only *singleton first-born live births*, leaving aside sample selection problems arising from parity considerations (infants that are not first-born) and abortions. We drop births to Native American women in the military, births to Native American women no longer living in the U.S., and births with missing data. This leaves 81 singleton first-born live births to Native American women between 1979 and 1994 in the NLSY.

We work with seven endogenous variables: four birth inputs *maternal smoking* (*S*), *maternal drinking* (*D*), *first trimester prenatal care* (PC), and *maternal weight gain* (WG), and three birth outputs *gestational age* (*G*), *birth length* (BL), and *birth weight*