variable is nonsmoking here, the estimated effect is the benefit of smoking cessation, which is in turn equal to the absolute value of the adverse effect of smoking. To identify marginal distributions, I impose the standard LATE assumptions following Abadie et al. (2002):

Assumption 2 *For almost all values of* X :

   (i) Independence: (Y_1, Y_0, D_1, D_0) *is jointly independent of* Z *given* X.

   (ii) Nontrivial Assignment: $\Pr(Z = 1|X) \in (0, 1)$.

   (iii) First-stage: $E[D_1|X] \neq E[D_0|X]$.

   (iv) Monotonicity: $\Pr(D_1 \geq D_0|X) = 1$.

Assumption 2(i) implies that the tax increase exogenously affects the smoking status conditional on observables and that any effect of the tax increase on infant birth weight must be via the change in smoking behavior. This is plausible in my application since the tax increase acts as an exogenous shock.[17] Assumption 2(ii) and (iii) obviously hold in this sample. Assumption 2(iv) is plausible since an increase in cigarette tax rates would never encourage smoking for each individual.

5.4.1 The Marginal Treatment Effect and Local Average Treatment Effect

First, I estimate marginal effects of smoking cessation to see how the mean effect varies with the individual's tendency to smoke. The marginal treatment effect (MTE) is defined as follows:

$$MTE(x, p) = E[Y_1 - Y_0|X = x, P(Z, X) = p].$$

where $P(Z, X) = P(D = 1|Z, X)$, which is the probability of not smoking conditional on Z and X. In Heckman and Vytlacil (2005), the MTE is recovered as follows:

$$MTE(x, p) = \frac{\partial}{\partial p} E[Y|X = x, P(Z, X) = p].$$

Since the propensity score $p(Z, X) = \Pr(D = 1|Z, X)$ is unobserved for each agent, I estimate it using the probit specification:

$$p(Z, X) = \Phi(\alpha + \beta Z + X'\gamma). \tag{15}$$

Then with the estimated propensity score $\widehat{p}(Z, X)$ in (15), I estimate the following outcome equation:

$$Y = \mu(\widehat{p}(Z, X), X) + u \tag{16}$$

---

[17] The state cigarette tax rate and tax increases have been widely recognized as a valid instrument in the literature such as Evans and Ringel (1999), Lien and Evans (2005) and Hoderlein and Sasaki (2011), among others.