$\aleph^2$ MINIMUM - STIMATION METHOD OF PARAMETERS IN AN ECONOMETRIC MODEL WITH QUQLITATIVES VARIABLES

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Abstract. The article presents an estimate of parameters in an econometric model with calitative variables; the article show us how to work with multiple observations or with grouped dates. The model proves us that we have a better estimation of parameters using this kind of estimation instead of using a model with individual dates. The estimation method presented in this article is call minimum hi-square.

The estimation of parameters for an econometric model with qualitative variables in case that is working with multiples observations or with grouping data using the linear probabilistic model is better than we use the individual data.

We suppose that have n_i observations for variable x_i and suppose too that for m_i observations we have the probe i and suppose that for $n_i - m_i$ observations the we don't have the probe . Then the empiric probability are:

$$\hat{p} = m_i n_i$$

We suppose that we have the theoretical probability like:

$$p_i = \beta' x_i$$

This is a linear probability function. The name is because the probability p_i is a linear mixture of the regressing factors x_i. We can write the last equation in this way:

$$\hat{p}_i = \beta' x_i + u_i. \tag{1}$$

where $u_i = \hat{p}_i - p_i$.

When we discuss about large sample we have $\hat{p}_i p_i$ and $E(u_i)0$. The following equality , $\text{var}(\hat{p}_i) = p_i(1 - p_i)n_i$, which can be estimated through $\hat{p}_i(1 - \hat{p}_i)n_i$ if n_i is a large number. We can use the least squares weight for estimate method β in equality number (1), using as weights:

$$w_i = (\hat{p}_i(1 - \hat{p}_i)n_i)^{-\frac{1}{2}}$$

The method that is describe is call the minimum χ^2. In a log-linear model we have:

$$\log\ p_i = \beta' x_i.$$

In this case we can write:

$$\log\ \hat{p}_i = \beta' x_i + u_i$$

where $u_i = \log\ \hat{p}_i - \log\ p_i$.

If we develop log $\hat{p}_i$ around the p_i in a Taylor series we have:

$$\log\ \hat{p}_i = \log\ p_i + (\hat{p}_i + p_i)1p_i + \textit{the terms with bigger orders}$$

because $u_i(\hat{p}_i + p_i)1p_i$. In large sample $E(u_i)0$, and then:

$$\text{var}(u_i) = 1p_i^2 p_i(1 - p_i)n_i = (1 - p_i)p_i\ .$$

We can estimate again this through $(1 - \hat{p}_i)n_i\hat{p}_i$. Now in the estimation stage through least squares weight method we use $[(1 - \hat{p}_i)\hat{p}_i]^{-\frac{1}{2}}$. for weights. This is the minimum of χ^2 method in a log-linear model.

In the logit model we consider the following:

$$\log p_i 1 - p_i = \beta' x_i$$

We can write again:

$$\log \hat{p}_i 1 - \hat{p}_i = \beta' x_i + u_i$$

where

$$u_i = \log\ \hat{p}_i 1 - \hat{p}_i - \log\ p_i 1 - p_i.$$

Using the development in Taylor series of $\log \hat{p}_i 1 - \hat{p}_i$ around p_i we obtain, if we leave the bigger orders terms, like before:

$$u_i(\hat{p}_i - p_i)\,(1p_i + 11 - p_i) = 1p_i(1 - p_i)(\hat{p}_i - p_i).$$

In big samples $E(u_i)0$ and

$$\text{var}(u_i) = 1[p_i(1 - p_i)]^2 p_i(1 - p_i)n_i = 1n_i p_i(1 - p_i)\ .$$

We can estimate again $\text{var}(u_i)$ through $1[n_i p_i(1 - p_i)]$ and can use the least squares weight method for estimate the parameters.

The conclusion of the article is that the hi-square method is very useful in estimation of parameters specially when we worked with groups of data using the linear probabilistic model. How can be observe this method of estimation can be use with success in the log-linear model too and in the logit model because the work mode is not very complicated and not very hard.

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