PS1

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Classify a model from a journal

(a) Research paper

The paper I am choosing is "Reallocation and Technology: Evidence from the US Steel Industry" by Allan Collard-Wexler and Jan De Loecker from American Economic Review. This paper focuses on identifying the impact of a drastic new technology – the minimills– on steel industry's productivity in US and understands the mechanism underlying the transmission from new technologies to increased productivity.

(b) Detailed citation

Collard-Wexler, Allan, and Jan De Loecker. 2015. "Reallocation and Technology: Evidence from the US Steel Industry." American Economic Review, 105(1): 131-71.

(c)-(e) The model, endogenous/exogenous variables and model classification

Model

The major model in this paper depicts the Data Generating Process (DGP) underlying a production process (i.e. production function) with specific features to capture the endogeneity of firm's input decision, which is assumed to be exogenous in a large body of previous literature.

$$q_{it} = \beta_l l_{it} + \beta_m m_{it} + \beta_k k_{it} + \omega_{it} + \epsilon_{it}$$

Where q represents the log of real production of the plant, l represents the log of real labor input, m is the log of real intermediate inputs, k is the log of real capital stock, ω is the log of Hicks-neutral productivity term and ϵ is the residuals capturing measurement error and unexpected shocks.

$$i_{it} = i_t(k_{it}, \omega_{it})$$

This formula further specifies that the firm's investment decision is based on previous capital stock and current productivity and productivity is following the AR(1) Hicks-neutral law of motion below:

$$\omega_{it} = g(\omega_{it-1}) + \xi_{it}$$

Endogeneity of the variables

unlike previous research on production function, even though labor input:l and intermediate material input: m are still regarded as exogenous, the capital input: k is endogenized to base on productivity term: ω. And the measurement error: ϵ and productivity shock ξ are regarded as exogenous. Therefore, the exogenous variables in the model remain to be: labor(l), intermediate material(m), measurement error(ϵ) and productivity shock (ξ) while all other variables are endogenously determined within the DGP.

Model classificiation

This model is a dynamic model, a quasi-linear model in the sense that the main production is a log-linear relation between inputs and output of production based on Cobb-Douglas production function, however, the inverse function of productivity derived from inveestment decision formula (second formula above) is a non-linear non-parametric function. Lastly, the model is a semi-deterministic model with certain stochastic feature like the productivity shock ξ which is assumed to be exogenous and orthogonal to all the other variables.

Potential improvement of the model

A major potential improvement to this model is the Cobb-Douglas style log-linear relation between output and input. I think an interesting extension would be to use other production function form like Constant Elasticity Substitution (CES) to identify the productivity, the non-linearity feature of which could lead to very different derived pattern of productivity.

2. Make your own model (Marriage decision)

(a)-(c) The model

I would like to develop a dynamic model of marriage decision-making process.

The individual would like to complete the following maximization problem at each time period t:

$$\max_{X} E[\sum_{t=t_0}^{T} \beta u(X_{it}; b_{it}^m, b_{it}^s, c_{it}^m, c_{it}^s, \xi_{it})]$$

where β is a discount coefficient between 0 and 1, and $u(.)$ is the utility function of this individual based on: X a binary decision variable of whether to get married (similarly in the future with a married status, it could also indicated whether to get a divorce) with 1 being married and 0 remaining single, b^m, b^s, c^m and c^s are EXPECTED benefits and cost of being married and being single respectively and ξ is the unexpected shocks that could change the utility function in the current period. To be more specific on the utility function:

$$u(X_{it}; b_{it}^m, b_{it}^s, c_{it}^m, c_{it}^s, \xi_{it}) = \frac{[X_{it}(b_{it}^m - c_{it}^m) + (1 - X_{it})(b_{it}^s - c_{it}^s) + \xi_{it}]^{1-\alpha}}{1-\alpha}$$

Essentially, this utility function is based on a cost-benefit analysis framework. And $\{b^m, b^s, c^m, c^s\}$ are themselves a function of time-dependent function of their respective exogenous variables. To save the space, I will use b_{it}^m — the benefit of marriage as an example:

$$b_{it}^m = g_t(b_{it-1}^m; \delta^{wage}, \delta^{happiness}, \delta^{health}) + \xi_{it}^m$$

The current benefits of marriage could be dependent of the previous marriage benefits, but also on some expected change in income, happiness(probably quantified through a survey study) and health related benefits, and also in unexpected effect included in ξ^m like the birth of a baby (which may also be factored into the cost of marriage).

(d) - (f)Why the factors included in the model are significant and how to test it

First of all, 93% of employers in the United States provide health insurance to married couples (corresponding to my δ^{health}) There is marital wage premium for males, according to the survey "Summary Statistics of White Young Men Classified by Marital Status in 1976", which was done by Korenman and Neumark, the hourly wage of married spouses present is USD6.57, and hourly wage of the never married is USD5.56, which was approximately 15% lower than that of the married spouse present. Besides, the patience coefficient I included will differentiate people based on their distribution weight of present and future utility.

One way to test out my model would be using life-time demographic survey — using one subset of the sample to calibrate the coefficient of the model (e.g., β and α) and then use my model and calibrated coefficient to generate marraige decision (X) based on exogenous variables (e,g., δ^{wage},$\delta^{happiness}$,δ^{health}). Then we could evaluate the model's performance based on the discrepancy between predicted decision and decision in real-life documented by the life-time demographic survey.

Reference

Badgett, M.V. Lee (1 July 2010). "The Economic Value of Marriage for Same-sex Couples" (PDF). Drake Law Review. Retrieved 2 March 2015.

Collard-Wexler, Allan, and Jan De Loecker. 2015. "Reallocation and Technology: Evidence from the US Steel Industry." American Economic Review, 105(1): 131-71.

Korenman, Sanders; Neumark, David (1991). "Does Marriage Really Make Men More Productive?". Journal of Human Resources. 26 (2): 282-307. CiteSeerX 10.1.1.464.1424