Notes for Math Equation

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1 Basic Math Structure

1.1 Inline math

Given production function $f(L, K) = L^{\alpha}K^{\beta}$, which is a function of input labor and capital.

1.2 Newline math

Given production function

$$f(L, K) = L^{\alpha}K^{\beta},$$

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1.3 Equation Environment

Given production function

$$f(L, K) = L^{\alpha}K^{\beta},$$

which is a function of input labor and capital.

1.4 Alignment

Consider the Euler equation and capital accumulation as the following:

$$U(C_t) = \beta \times U(C_{t+1}) \times [1 + f(k_t) - \delta] \tag{1}$$
$$K_{t+1} = (1 - \delta)K_t + I_t \tag{2}$$

2 Basic Math Notation

2.1 Fraction

Define function $f(x)$ as following:

$$f(x) = \frac{1}{x}$$

$$\varepsilon_{ii} = \frac{\frac{\partial X_i}{X_i}}{\frac{\partial P_i}{P_i}}$$

$$f(x) = \frac{1}{2}$$

$$f(x) = \frac{1}{x}$$

2.2 Square Root

$$x = \sqrt{3}$$

$$x = \sqrt[2]{3}$$

$$x = \frac{1}{\sqrt{3}}$$

$$x = \sqrt{a + b + y^2}$$

2.3 Power and Integral

Define a quadratic function $f(x)$ as following:

$$f(x) = x^2$$

Given the expectation $E(x)$,

$$E(X) = \int_{-\infty}^{\infty} X f_x(x) dx$$

Given interval $[a, b]$,

$$E(X) = \iiint_{b}^{a} X f_x(x) dx$$

2.4 Summation

For discrete RVs, the expectation is defined as,

$$E(X) = n^{-1} \times \sum_{i=1}^{N} X_i.$$

Or

$$E(X) = \frac{1}{n} \times \sum_{i=1}^{N} X_i.$$

$$E(X) = n^{-1} \times \sum\nolimits_{i=1}^{N} X_i.$$

The utility maximization problem becomes

$$\max_{\substack{c_s,k_s \\ l_s}} \sum_{s=0}^{\infty} \beta^{s-t} U(C_s)$$

Or you can use this way:

$$\max_{\substack{c_s,k_s \\ l_s}} \sum_{s=0}^{\infty} \beta^{s-t} U(C_s)$$

2.5 Production

The generalized form for Cobb-Douglas utility function is

$$U(X_1, ..., X_n) = \prod_{i=1}^{n} X_i^{\alpha_i}$$

For dot production(matrix)

$$X_1 \cdot Y_1$$

2.6 Limitation

The Variance of $E(x)$ is defined by

$$\begin{aligned} Var(E(X)) &= Var(n^{-1} \times \sum_{i=1}^{N} X_i) \\ &= \frac{1}{n^2} \times \sum_{i=1}^{N} Var(X_i) \\ &= \frac{\sigma^2}{n} \end{aligned}$$

When n goes to infinity,

$$\begin{aligned}\lim_{n\to\infty} Var(E(X)) &= \lim_{n\to\infty} \frac{\sigma^2}{n} \\ &= 0\end{aligned}$$

2.7 Differentiation

The own price elasticity for good i is defined by

$$\epsilon_{ii} = \frac{\partial X_i}{\partial P_i}\frac{P_i}{X_i}$$

$$\begin{aligned}\epsilon_{ii} &= \frac{\partial X_i}{\partial P_i}\frac{P_i}{X_i} \\ &= \frac{\frac{\partial X_i}{X_i}}{\frac{\partial P_i}{P_i}} \\ &= \frac{lnX_i}{lnP_i} \\ &= \frac{\Delta X_i}{\Delta P_i}\end{aligned}$$

2.8 Binomial Operation

Binomial distribution with density function

$$f(x;\theta) = \binom{n}{x}\theta^x(1-\theta)^{n-x}$$

where $\binom{n}{x} = \frac{n!}{(n-x)!x!}$

Or you can right in this method,

$$\binom{n}{x}$$

2.9 Convergence

Denote μ_r' converge to standard normal distribution in distribution as the following:

$$\mu_r' \xrightarrow{d} N(0,1)$$

2.10 Head-Notation

$$y = x\hat{\beta} + \varepsilon$$

Average of x is $\bar{x}$

2.11 Density Function

$$f(x;\theta) = \begin{cases} \frac{1}{b-a} & if x \in [a,b] \\ \emptyset & O.W \end{cases}$$

2.12 Matrix

$$\begin{bmatrix} 1 & 2 & 1 \\ 3 & 8 & 1 \\ 5 & 1 & 1 \end{bmatrix}$$

$$\begin{pmatrix} 1 & 2 & 1 \\ 3 & 8 & 1 \\ 5 & 1 & 1 \end{pmatrix}$$

$$\begin{pmatrix} 1 & x_{11} & x_{12} \cdots x_{1k} \\ 1 & x_{21} & x_{22} \cdots x_{2k} \\ \vdots & \vdots & \ddots \vdots \\ 1 & x_{n1} & x_{n2} \cdots x_{nk} \end{pmatrix}$$

$$A = \begin{pmatrix} 1 & 0 & & \\ 0 & 1 & 0 & \\ & 0 & 1 & 0 \\ & & 0 & 1 \end{pmatrix}$$

$$B = \begin{pmatrix} 1 & 0 & & \\ 0 & 1 & 0 & \\ & 0 & 1 & 0 \\ & & 0 & 1 \end{pmatrix}$$

2.13 Bracket

$$\lim_{x \to 0} \left(\frac{a^x + b^x + c^x}{3} \right)^{\frac{1}{x}}$$

This is a **fantastic** way to formalized the bracket in your equation.

3 Insert Materials

3.1 Graphics

Name	Display	Name	Display	Name	Display	Name	Display
\times	×	\div	÷	\pm	±	\mp	∓
\otimes	⊗	\ominus	⊖	\oplus	⊕	\odot	⊙
\oslash	⊘	\triangleq	≜	\ne	≠	\equiv	≡
\lt	<	\gt	>	\le	≤	\ge	≥
\cup	∪	\cap	∩	\Cup	⋓	\Cap	⋒
\bigcup	⋃	\bigcap	⋂	\ast	*	\star	⋆
\bigotimes	⨂	\bigoplus	⨁	\circ	∘	\bullet	∙
\bigcirc	◯	\amalg	⨿	\to	→	\infty	∞
\vee	∨	\wedge	∧	\lhd	◁	\rhd	▷
\bigvee	⋁	\bigwedge	⋀	\unlhd	⊴	\unrhd	⊵
\sqcap	⊓	\sqcup	⊔	\prec	≺	\succ	≻
\subset	⊂	\supset	⊃	\sim	∼	\approx	≈
\subseteq	⊆	\supseteq	⊇	\cong	≅	\doteq	≐
\setminus	∖	\mid	∣	\ll	≪	\gg	≫
\parallel	∥	\Join	⋈	\in	∈	\notin	∉
\propto	∝	\neg	¬	\ldots	…	\cdots	⋯
\forall	∀	\exists	∃	\vdots	⋮	\ddots	⋱
\aleph	ℵ	\nabla	∇	\imath	ɪ	\jmath	ȷ
\ell	ℓ	\partial	∂	\int	∫	\oint	∮
\uplus	⊎	\biguplus	⨄				