
THE THESIS TITLE^{*}

Your Name[†]
Department of Economics

2022

ABSTRACT

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Keywords: keyword 1, keyword 2

JEL Codes: J02, R10

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1 Introduction

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2 Model

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Theorem 1 (Envelope Theorem). *Only the direct effects of a change in an exogenous variable need be considered, even though the exogenous variable may enter the maximum value function indirectly as part of the solution to the endogenous choice variables. The proof is in [Appendix B](#).*

The [competition](#) can be illustrated with the following graph with the implementation is presented in [Listing 1](#):

Figure 1: This is a graph



Note: some notes. The graph should be self-contained. Nunc sed pede. Praesent vitae lectus. Praesent neque justo, vehicula eget, interdum id, facilisis et, nibh. Phasellus at purus et libero lacinia dictum. Fusce aliquet. Nulla eu ante placerat leo semper dictum. Mauris metus. Curabitur lobortis. Curabitur sollicitudin hendrerit nunc. Donec ultrices lacus id ipsum.

3 Comparative Statics

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This is also demonstrated in Figure 1. Download this template at the [Github repository](#).

Listing 1: Long short-term memory

```
1 class network_LSTM(nn.Module):
2     def __init__(self, input_size=1, hidden_size=256, output_size=1):
3         super().__init__()
4         self.hidden_size = hidden_size
5         self.lstm = nn.LSTM(input_size, hidden_size)
6
7         # fully-connected
8         self.linear = nn.Linear(hidden_size, output_size)
9
10        self.hidden = (
11            torch.zeros(1, 1, self.hidden_size),
12            torch.zeros(1, 1, self.hidden_size)
13        )
14
15    def forward(self, vec):
16        lstm_output, self.hidden = self.lstm(vec.view(len(vec), 1, -1), self.hidden)
17        prediction = self.linear(lstm_output.view(len(vec), -1))
18        return prediction[-1]
```

4 Empirical Results

We follow the approach from [Harding and Lamarche \(2019\)](#). Quisque facilisis auctor sapien. Pellentesque gravida hendrerit lectus. Mauris rutrum sodales sapien. Fusce hendrerit sem vel lorem. Integer pellentesque massa vel augue. Integer elit tortor, feugiat quis, sagittis et, ornare non, lacus. Vestibulum posuere pellentesque eros. Quisque venenatis ipsum dictum nulla. Aliquam quis quam non metus eleifend interdum. Nam eget sapien ac mauris malesuada adipiscing. Etiam eleifend neque sed quam. Nulla facilisi. Proin a ligula. Sed id dui eu nibh egestas tincidunt. Suspendisse arcu. By using this approach, comparable results can be obtained ([Chen, Esteban and Shum, 2013](#)).

To calculate the ELBO³, we start from using the property of the KL-divergence. Nulla ac nisl. Nullam urna nulla, ullamcorper in, interdum sit amet, gravida ut, risus. Aenean ac enim. In luctus. Phasellus eu quam vitae turpis viverra pellentesque. Duis feugiat felis ut enim. Phasellus pharetra, sem id porttitor sodales, magna nunc aliquet nibh, nec blandit nisl mauris at pede. Suspendisse risus risus, lobortis eget, semper at, imperdiet sit amet, quam. Quisque

³More information about the evidence lower bound (ELBO) can be found on the [Wikipedia](#).

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The data can be summarized by the tables with decimal alignment below:

Table B.1a: First Table

Category	Total	Shares (%)	Female	Male	Asian	Black/AA	His./Latino	White/Cau.	Zeros (%)
child care	19.39	0.08	12.32	20.12	23.14	63.78	20.24	19.00	0.07
eating	30.35	6.12	35.97	6.23	24.61	21.58	38.18	2.02	0.00
education	9.91	0.04	9.94	90.54	9.69	7.99	10.64	10.14	0.90
entertainment (not TV)	26.05	0.10	29.19	26.60	33.36	26.13	4.43	25.15	0.45

Note: This is the first table.

Table B.1b: Second Table

Category	Total	Shares (%)	Female	Male	Asian	Black/AA	His./Latino	White/Cau.	Zeros (%)
child care	19.39	0.08	39.32	40.12	23.14	18.78	20.24	19.00	0.07
personal care	13.92	0.06	24.00	23.14	16.12	1.76	15.15	13.66	0.00
sports/exercise	20.44	0.08	20.38	31.00	24.99	25.48	20.71	20.07	0.53
TV	28.61	0.12	48.47	9.93	2.35	63.70	29.22	80.20	0.46

Note: This is the second table.

In the following, we present the algorithm:

5 Algorithm

Algorithm 1: Euclid’s algorithm for finding the greatest common divisor of two nonnegative integers

function Euclid (a, b);

Input : Two nonnegative integers a and b

Output : $\gcd(a, b)$

if $b = 0$ **then**

 return a ;

else

 return Euclid($b, a \bmod b$);

end

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molestie non, scelerisque at, vestibulum eu, nulla. Ut odio nisl, facilisis id, mollis et, scelerisque nec, enim. Aenean sem leo, pellentesque sit amet, scelerisque sit amet, vehicula pellentesque, sapien.

Table 2: Summary Statistics

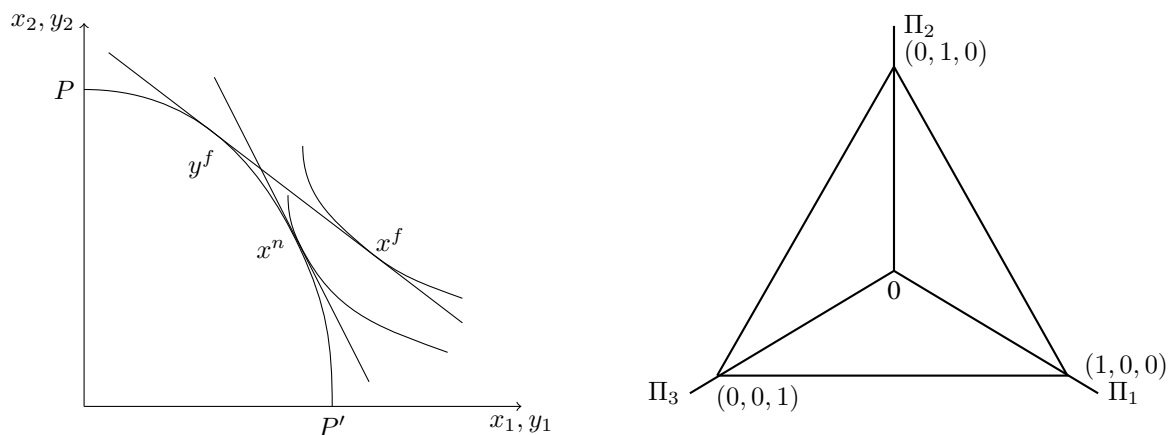
	Cohort		
	2006	2007	2008
Students registered	1535	1584	1767
Gender (%)			
Male	61.1	64.5	57.7
Female	38.9	35.5	42.3
Race (%)			
White	43.3	43.4	40.6
Black	29.8	33.4	34.8

Note: Source: UCT Institutional Planning Department

6 Conclusion

Sed commodo posuere pede. Mauris ut est. Ut quis purus. Sed ac odio. Sed vehicula hendrerit sem. Duis non odio. Morbi ut dui. Sed accumsan risus eget odio. In hac habitasse platea dictumst. Pellentesque non elit. Fusce sed justo eu urna porta tincidunt. Mauris felis odio, sollicitudin sed, volutpat a, ornare ac, erat. Morbi quis dolor. Donec pellentesque, erat ac sagittis semper, nunc dui lobortis purus, quis congue purus metus ultricies tellus. Proin et quam. Class aptent taciti sociosqu ad litora torquent per conubia nostra, per inceptos hymenaeos. Praesent sapien turpis, fermentum vel, eleifend faucibus, vehicula eu, lacus.

We graph with `tikz` in \LaTeX :



References

- Chen, Jiawei, Susanna Esteban, and Matthew Shum.** 2013. “[When Do Secondary Markets Harm Firms?](#)” *American Economic Review*, 103(7): 2911–2934.
- Dong, Yingying, and Shu Shen.** 2018. “[Testing for Rank Invariance or Similarity in Program Evaluation.](#)” *Review of Economics and Statistics*, 100(1): 78–85.
- Harding, Matthew, and Carlos Lamarche.** 2019. “[A panel quantile approach to attrition bias in Big Data: Evidence from a randomized experiment.](#)” *Journal of Econometrics*, 211(1): 61–82.
- Lee, Ying-Ying.** 2018. “[Efficient propensity score regression estimators of multivalued treatment effects for the treated.](#)” *Journal of Econometrics*, 204(2): 207–222.

Appendices

A Additional Discussion

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B Proof of Theorem 1

We will proof the following equation:

Proof. Given $y, x, \Delta, \nu, \eta, \mathcal{L} = \begin{pmatrix} 1 & 2 & 3 & 4 & 5 \\ 3 & 4 & 5 & 6 & 7 \end{pmatrix}$, and $\Pi = \begin{vmatrix} A & B & C \\ D & E & F \end{vmatrix}$, if

$$\begin{cases} \text{trade,} & p(\text{trade}) = \frac{y}{v} \\ \text{no trade,} & p(\text{no trade}) = 1 - \frac{y}{v} \end{cases}$$

then we have

$$\begin{aligned} y &= \mathbb{E}_{\pi}(\beta x + \epsilon) \\ &\neq \sum_i \beta_i (\underbrace{\alpha + \xi}_{\text{variables}}) + \epsilon \end{aligned} \tag{1}$$

$$\implies \int_0^{10} r \left(\frac{r}{50} \right) dr \stackrel{\text{text here}}{=} \frac{r^3}{150} \bigg|_0^{10}, \forall x \in (a, b) \tag{2}$$

So from \widehat{ABCD} , \widetilde{ABCD} , \widehat{ABCD} , \overrightarrow{ABCD} , and \overline{ABCD} , we get the desire result. ■

Consider $g(x) = f(x) - x$, since $f(x)$ and x are continuous, then $g : [a, b] \rightarrow \mathbb{R}$ is continuous. Then

$$g(a) = f(a) - a > 0, \quad g(b) = f(b) - b < 0$$

By IVT: $\exists c \in (a, b)$ s.t. $g(c) = 0 \implies \exists c \in (a, b)$ s.t. $f(c) - c = 0 \implies f(c) = c$.