THE THESIS TITLE*

Your Name†
Department of Economics

2022

ABSTRACT

Nulla malesuada porttitor diam. Donec felis erat, congue non, volutpat at, tincidunt tristique, libero. Vivamus viverra fermentum felis. Donec nonummy pellentesque ante. Phasellus adipiscing semper elit. Proin fermentum massa ac quam. Sed diam turpis, molestie vitae, placerat a, molestie nec, leo. Maecenas lacinia. Nam ipsum ligula, eleifend at, accumsan nec, suscipit a, ipsum. Morbi blandit ligula feugiat magna. Nunc eleifend consequat lorem. Sed lacinia nulla vitae enim. Pellentesque tincidunt purus vel magna. Integer non enim. Praesent euismod nunc eu purus. Donec bibendum quam in tellus. Nullam cursus pulvinar lectus. Donec et mi. Nam vulputate metus eu enim. Vestibulum pellentesque felis eu massa. Download this template at the Github repository.

Keywords: keyword 1, keyword 2

JEL Codes: J02, R10

*We thank someone for excellent research assistance. We thank someone for their comments and suggestions.
†Your address; Email: yourEmail@email.com.

1 Introduction

Quisque ullamcorper placerat ipsum. Cras nibh. Morbi vel justo vitae lacus tincidunt ultrices. Lorem ipsum dolor sit amet, consectetuer adipiscing elit. In hac habitasse platea dictumst. Integer tempus convallis augue. Etiam facilisis. Nunc elementum fermentum wisi. Aenean placerat. Ut imperdiet, enim sed gravida sollicitudin, felis odio placerat quam, ac pulvinar elit purus eget enim. Nunc vitae tortor. Proin tempus nibh sit amet nisl. Vivamus quis tortor vitae risus porta vehicula. Many previous research has has studied this problem (Lee, 2018, Dong and Shen, 2018). Download this template at the Github repository.

2 Model

Fusce mauris. Vestibulum luctus nibh at lectus. Sed bibendum, nulla a faucibus semper, leo velit ultricies tellus, ac venenatis arcu wisi vel nisl. Vestibulum diam. Aliquam pellentesque, augue quis sagittis posuere, turpis lacus congue quam, in hendrerit risus eros eget felis. Maecenas eget erat in sapien mattis porttitor. Vestibulum porttitor. Nulla facilisi. Sed a turpis eu lacus commodo facilisis. Morbi fringilla, wisi in dignissim interdum, justo lectus sagittis dui, et vehicula libero dui cursus dui. Mauris tempor ligula sed lacus. Duis cursus enim ut augue. Cras ac magna. Cras nulla. Nulla egestas. Curabitur a leo. Quisque egestas wisi eget nunc. Nam feugiat lacus vel est. Curabitur consectetuer. More are discussed in Appendix A.

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

Suspendisse vel felis. Ut lorem lorem, interdum eu, tincidunt sit amet, laoreet vitae, arcu. Aenean faucibus pede eu ante. Praesent enim elit, rutrum at, molestie non, nonummy vel, nisl. Ut lectus eros, malesuada sit amet, fermentum eu, sodales cursus, magna. Donec eu purus. Quisque vehicula, urna sed ultricies auctor, pede lorem egestas dui, et convallis elit erat sed nulla. Donec luctus. Curabitur et nunc. Aliquam dolor odio, commodo pretium, ultricies non, pharetra in, velit. Integer arcu est, nonummy in, fermentum faucibus, egestas vel, odio. The results are presented in Appendix B.1b.

This is also demonstrated in Figure 1. Download this template at the Github repository.

Listing 1: Long short-term memory

```
class network_LSTM(nn.Module):
   def __init__(self, input_size=1, hidden_size=256, output_size=1):
      super().__init__()
      self.hidden_size = hidden_size
      self.lstm = nn.LSTM(input_size, hidden_size)

      # fully-connected
      self.linear = nn.Linear(hidden_size, output_size)

      self.hidden = (
         torch.zeros(1, 1, self.hidden_size),
         torch.zeros(1, 1, self.hidden_size)
      )

   def forward(self,vec):
      lstm_output, self.hidden = self.lstm(vec.view(len(vec),1,-1), self.hidden)
      prediction = self.linear(lstm_output.view(len(vec),-1))
      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 ELBO[3], 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

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

scelerisque dapibus nibh. Nam enim. Lorem ipsum dolor sit amet, consectetuer adipiscing elit. Nunc ut metus. Ut metus justo, auctor at, ultrices eu, sagittis ut, purus. Aliquam aliquam.

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$(b, a \mod b)$;
end

Sed mattis, erat sit amet gravida malesuada, elit augue egestas diam, tempus scelerisque nunc nisl vitae libero. Sed consequat feugiat massa. Nunc porta, eros in eleifend varius, erat leo rutrum dui, non convallis lectus orci ut nibh. Sed lorem massa, nonummy quis, egestas id, condimentum at, nisl. Maecenas at nibh. Aliquam et augue at nunc pellentesque ullamcorper. Duis nisl nibh, laoreet suscipit, convallis ut, rutrum id, enim. Phasellus odio. Nulla nulla elit,

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

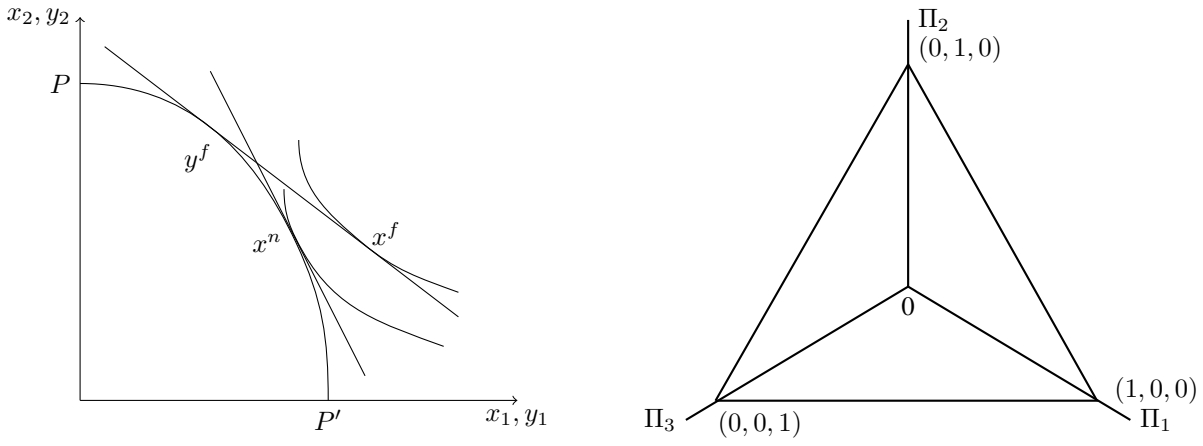
	Cohort		
	2006	2007	2008
Students registered	1535	1584	1767
Gender (%)			
Male	61.1	64.5	57.7
Female	38.9	35.5	42.3
Race (%)			
White	43.3	43.4	40.6
Black	29.8	33.4	34.8

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

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 scelerisque dapibus nibh. Nam enim. Lorem ipsum dolor sit amet, consectetuer adipiscing elit. Nunc ut metus. Ut metus justo, auctor at, ultrices eu, sagittis ut, purus. Aliquam aliquam.

B Proof of Theorem 1

We will proof the following equation:

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

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

then we get the following:

$$\begin{aligned} y &= \mathop{\mathbb{E}}_{\pi}\Big(\beta x + \epsilon\Big) \\ &\neq \sum_{i} \beta_i (\underbrace{\alpha + \xi}_{\text{variables}}) + \epsilon \qquad (1) \\ &\implies \int_0^{10} r \left(\frac{r}{50}\right) dr \overset{\text{text here}}{=\!=\!=} \frac{r^3}{150}\bigg|_0^{10}, \forall x \in (a, b) \qquad (2) \end{aligned}$$

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 $g : [a, b] \to \mathbb{R}$ is continuous. Then

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

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