UNIVERSITY OF CALIFORNIA,
IRVINE

Title of the Thesis

DISSERTATION

Submitted in Partial Satisfaction of the Requirements
for the degree of

DOCTOR OF PHILOSOPHY

in Economics

by

Your Name

Dissertation Committee:
Professor Name1 (Chair)
Associate Professor Name2
Associate Professor Name3
Assistant Professor Name4

2022

DEDICATION

To someone for their support.

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

ACKNOWLEDGMENTS

I would like to thank NameOfCommitteeChair for his support and guidance over the past few years.

I am grateful to some for her guidance.

I am incredibly thankful to my colleagues at UC Irvine for their friendship and encouragement.

I would like to thank many people. Last, but not least, I thank someone for their support over the years.

Download this template at the Github repository.

CURRICULUM VITAE

Your Name

EDUCATION

Doctor of Philosophy in Economics **YYYY**
University of California, Irvine *Irvine, CA*

Masters of Science in Economics **YYYY**
University of Wisconsin, Madison *Madison, WI*

Bachelor of Arts in Economics **YYYY**
University of California, Los Angeles *Los Angeles, CA*

FIELDS OF STUDY

Econometrics, Industrial Organization

ABSTRACT OF THE DISSERTATION

Title of the Thesis

By

Your Name

Doctor of Philosophy in Economics

University of California, Irvine, 2022

Professor NameOfCommitteeChair, Chair

The chapters of this dissertation explore different aspects in Economics.

Chapter 1

Title of Chapter One

This chapter explores the aspect of firm competitions. Sed feugiat. Cum sociis natoque penatibus et magnis dis parturient montes, nascetur ridiculus mus. Ut pellentesque augue sed urna. Vestibulum diam eros, fringilla et, consectetuer eu, nonummy id, sapien. Nullam at lectus. In sagittis ultrices mauris. Curabitur malesuada erat sit amet massa. Fusce blandit. Aliquam erat volutpat. Aliquam euismod. Aenean vel lectus. Nunc imperdiet justo nec dolor.

Download this template at the Github repository.

1.1 Introduction

The competition can be illustrated with the following graph with the implementation is presented in Listing 1.1:

Figure 1.1: 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.

1.2 Model

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. The proof is 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.*

1.3 Comparative Statics

This is also demonstrated in Figure 1.1.

Listing 1.1: 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]
```

1.4 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.

Chapter 2

Title of Chapter Two

This chapter explores two-side markets. 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.

2.1 Introduction

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).

2.2 Model

Phasellus placerat vulputate quam. Maecenas at tellus. Pellentesque neque diam, dignissim ac, venenatis vitae, consequat ut, lacus. Nam nibh. Vestibulum fringilla arcu mollis arcu. Sed et turpis. Donec sem tellus, volutpat et, varius eu, commodo sed, lectus. Lorem ipsum dolor sit amet, consectetuer adipiscing elit. Quisque enim arcu, suscipit nec, tempus at, imperdiet vel, metus. Morbi volutpat purus at erat. Donec dignissim, sem id semper tempus, nibh massa

eleifend turpis, sed pellentesque wisi purus sed libero. Nullam lobortis tortor vel risus. Pellentesque consequat nulla eu tellus. Donec velit. Aliquam fermentum, wisi ac rhoncus iaculis, tellus nunc malesuada orci, quis volutpat dui magna id mi. Nunc vel ante. Duis vitae lacus. Cras nec ipsum.

2.3 Identification

Nulla mattis luctus nulla. Duis commodo velit at leo. Aliquam vulputate magna et leo. Nam vestibulum ullamcorper leo. Vestibulum condimentum rutrum mauris. Donec id mauris. Morbi molestie justo et pede. Vivamus eget turpis sed nisl cursus tempor. Curabitur mollis sapien condimentum nunc. In wisi nisl, malesuada at, dignissim sit amet, lobortis in, odio. Aenean consequat arcu a ante. Pellentesque porta elit sit amet orci. Etiam at turpis nec elit ultricies imperdiet. Nulla facilisi. In hac habitasse platea dictumst. Suspendisse viverra aliquam risus. Nullam pede justo, molestie nonummy, scelerisque eu, facilisis vel, arcu. To calculate the ELBO[1], we start from using the property of the KL-divergence.

2.4 Empirical Results

The results are presented in Appendix B.1b. Download this template at the Github repository.

2.5 Conclusion

Ut auctor, augue porta dignissim vestibulum, arcu diam lobortis velit, vel scelerisque risus augue sagittis risus. Maecenas eu justo. Pellentesque habitant morbi tristique senectus et netus et malesuada fames ac turpis egestas. Mauris congue ligula eget tortor. Nullam laoreet urna sed enim. Donec eget eros ut eros volutpat convallis. Praesent turpis. Integer mauris diam, elementum quis, egestas ac, rutrum vel, orci. Nulla facilisi. Quisque adipiscing, nulla vitae elementum porta, sem urna volutpat leo, sed porta enim risus sed massa. Integer ac enim quis diam sodales luctus. Ut eget eros a ligula commodo ultricies. Donec eu urna viverra dolor hendrerit feugiat. Aliquam ac orci vel eros congue pharetra. Quisque rhoncus, justo eu volutpat faucibus, augue leo posuere lacus, a rhoncus purus pede vel est. Proin ultrices enim.

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

Chapter 3

Title of Chapter Three

This chapter estimates the treatment effects. Pellentesque interdum sapien sed nulla. Proin tincidunt. Aliquam volutpat est vel massa. Sed dolor lacus, imperdiet non, ornare non, commodo eu, neque. Integer pretium semper justo. Proin risus. Nullam id quam. Nam neque. Duis vitae wisi ullamcorper diam congue ultricies. Quisque ligula. Mauris vehicula.

3.1 Introduction

Many previous research has has studied this problem (Lee, 2018, Dong and Shen, 2018). Download this template at the Github repository.

3.2 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

3.3 Results

Donec a nibh ut elit vestibulum tristique. Integer at pede. Cras volutpat varius magna. Phasellus eu wisi. Praesent risus justo, lobortis eget, scelerisque ac, aliquet in, dolor. Proin id leo. Nunc iaculis, mi vitae accumsan commodo, neque sem lacinia nulla, quis vestibulum justo sem in eros. Quisque sed massa. Morbi lectus ipsum, vulputate a, mollis ut, accumsan placerat, tellus. Nullam in wisi. Vivamus eu ligula a nunc accumsan congue. Suspendisse ac libero. Aliquam erat volutpat. Donec augue. Nunc venenatis fringilla nibh. Fusce accumsan pulvinar justo. Nullam semper, dui ut dignissim auctor, orci libero fringilla massa, blandit pulvinar pede tortor id magna. Nunc adipiscing justo sed velit tincidunt fermentum.

Table 3.1: 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

Donec tempus neque vitae est. Aenean egestas odio sed risus ullamcorper ullamcorper. Sed in nulla a tortor tincidunt egestas. Nam sapien tortor, elementum sit amet, aliquam in, porttitor faucibus, enim. Nullam congue suscipit nibh. Quisque convallis. Praesent arcu nibh, vehicula eget, accumsan eu, tincidunt a, nibh. Suspendisse vulputate, tortor quis adipiscing viverra, lacus nibh dignissim tellus, eu suscipit risus ante fringilla diam. Quisque a libero vel pede imperdiet aliquet. Pellentesque nunc nibh, eleifend a, consequat consequat, hendrerit nec, diam. Sed urna. Maecenas laoreet eleifend neque. Vivamus purus odio, eleifend non, iaculis a, ultrices sit amet, urna. Mauris faucibus odio vitae risus. In nisl. Praesent purus. Integer iaculis, sem eu egestas lacinia, lacus pede scelerisque augue, in ullamcorper dolor eros ac lacus. Nunc in libero.

3.4 Conclusion

Vivamus vehicula leo a justo. Quisque nec augue. Morbi mauris wisi, aliquet vitae, dignissim eget, sollicitudin molestie, ligula. In dictum enim sit amet risus. Curabitur vitae velit eu diam rhoncus hendrerit. Vivamus ut elit. Praesent mattis ipsum quis turpis. Curabitur rhoncus neque eu dui. Etiam vitae magna. Nam ullamcorper. Praesent interdum bibendum magna. Quisque auctor aliquam dolor. Morbi eu lorem et est porttitor fermentum. Nunc egestas arcu at tortor varius viverra. Fusce eu nulla ut nulla interdum consectetuer. Vestibulum gravida. Morbi mattis libero sed est.

Bibliography

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.

Appendix A

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 have

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

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. $f(c) - c = 0 \implies f(c) = c$.

Appendix B

The data can be summarized by the tables 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.