



## UvA-DARE (Digital Academic Repository)

### Responses to the incidental parameter problem

Pua, A.A.Y.

**Publication date**

2016

**Document Version**

Final published version

[Link to publication](#)

**Citation for published version (APA):**

Pua, A. A. Y. (2016). *Responses to the incidental parameter problem*. [Thesis, externally prepared, Universiteit van Amsterdam].

**General rights**

It is not permitted to download or to forward/distribute the text or part of it without the consent of the author(s) and/or copyright holder(s), other than for strictly personal, individual use, unless the work is under an open content license (like Creative Commons).

**Disclaimer/Complaints regulations**

If you believe that digital publication of certain material infringes any of your rights or (privacy) interests, please let the Library know, stating your reasons. In case of a legitimate complaint, the Library will make the material inaccessible and/or remove it from the website. Please Ask the Library: <https://uba.uva.nl/en/contact>, or a letter to: Library of the University of Amsterdam, Secretariat, Singel 425, 1012 WP Amsterdam, The Netherlands. You will be contacted as soon as possible.

In recent years, we have seen an explosion of data collected from individuals, firms, or countries across short or long periods of time. This type of data gives us an opportunity to study the dynamics of change while controlling for time-invariant unobserved heterogeneity. Unfortunately, this type of heterogeneity, which is usually in the form of individual-specific fixed effects, creates problems for identification, estimation, and inference, especially if we continue to use default procedures without modification or without critical exploration. This dissertation revolves around a common theme – what practices and methods can be considered appropriate responses to the incidental parameter problem in panel data models. My approach to research is firmly rooted in the examination of empirical and theoretical practices so that we can come to an understanding of what we can and cannot do.

Andrew Adrian Yu Pua (1984) is no stranger to double degrees. He received a BA in Economics and a BSc in Accountancy from De La Salle University – Manila (DLSU). He also received a master's degree in mathematics from the same institution. After around three years as a faculty member of DLSU, he traveled to Europe to commence postgraduate studies. With the support of the European Commission through the Erasmus Mundus scheme, he obtained an MSc Wirtschaftsmathematik from Universität Bielefeld and a Master Mathématiques Appliquées à l'Economie et à la Finance from the Université Paris 1 Panthéon-Sorbonne. Now, with the support of the same commission, he is about to receive his PhD in Economics from both the University of Amsterdam and the Université Catholique de Louvain.

 UNIVERSITY OF AMSTERDAM

**UCL**  
Université  
catholique  
de Louvain



Responses to the Incidental Parameter Problem

---

# Responses to the Incidental Parameter Problem

Andrew Adrian Yu Pua

---

# Responses to the Incidental Parameter Problem

Dit proefschrift is tot stand gekomen in het kader van EDE-EM (European Doctorate in Economics – Erasmus Mundus), met als doel het behalen van een gezamenlijk doctoraat. Het proefschrift is voorbereid aan de Faculteit Economie en Bedrijfskunde van de Universiteit van Amsterdam en aan de Center for Operations Research and Econometrics van de Université Catholique de Louvain.

La thèse a été préparée dans le cadre du programme doctoral européen EDE-EM (European Doctorate in Economics – Erasmus Mundus). Cette thèse a été préparée conjointement au Faculteit Economie en Bedrijfskunde, Universiteit van Amsterdam et au Center for Operations Research and Econometrics, Université Catholique de Louvain.

This thesis has been written within the framework of the EDE-EM (European Doctorate in Economics – Erasmus Mundus), with the purpose of obtaining a joint doctorate degree. The thesis was prepared in the Faculty of Economics and Business at the University of Amsterdam and in the Center for Operations Research and Econometrics at the Université Catholique de Louvain.

Layout and cover design by Andrew Adrian Yu Pua

ISBN 978-94-91030-84-0

NUR 916

© Andrew Adrian Yu Pua, 2016

All rights reserved. Without limiting the rights under copyright reserved above, no part of this book may be reproduced, stored in, or introduced into a retrieval system, or transmitted, in any form or by any means (electronic, mechanical, photocopying, recording, or otherwise) without the written permission of both the copyright owner and author of the book.

# **RESPONSES TO THE INCIDENTAL PARAMETER PROBLEM**

ACADEMISCH PROEFSCHRIFT

ter verkrijging van de graad van doctor

aan de Universiteit van Amsterdam

op gezag van de Rector Magnificus

prof. dr. D. C. van den Boom

ten overstaan van een door het College voor Promoties ingestelde

commissie, in het openbaar te verdedigen in de Agnietenkapel

op donderdag 10 maart 2016, te 14:00 uur

door

Andrew Adrian Yu Pua

geboren te Manilla, Filipijnen

**Promotiecommissie:**

<b>Promotor:</b>	Prof. dr. H. P. Boswijk	Universiteit van Amsterdam
	Prof. dr. S. van Bellegem	Université Catholique de Louvain
<b>Copromotor:</b>	Dr. M. J. G. Bun	Universiteit van Amsterdam
<b>Overige leden:</b>	Prof. dr. G. Dhaene	Katholieke Universiteit Leuven
	Dr. K. J. van Garderen	Universiteit van Amsterdam
	Dr. N. P. A. van Giersbergen	Universiteit van Amsterdam
	Prof. dr. C. M. Hafner	Université Catholique de Louvain
	Prof. dr. S. Khan	Duke University
	Prof. dr. F. R. Kleibergen	Universiteit van Amsterdam
<b>Faculteit:</b>	Economie en Bedrijfskunde	

## Acknowledgements

I acknowledge the funding and support of the Education, Audiovisual and Culture Executive Agency (EACEA) of the European Union during my stay in Europe from September 2009 to August 2014. The agency financed both my scholarship for the Erasmus Mundus Master Course QEM and my fellowship for the Erasmus Mundus Joint Doctorate EDEEM. I also thank my promotor Peter Boswijk for offering a teaching gig that allowed me to stay at the University of Amsterdam until 1 February 2016.

I would like to thank six sets of people: my family, my friends, my colleagues, the participants at talks, the support staff, and the nameless future reader.

First, I spent most of my time with colleagues at the University of Amsterdam (UvA) and at the Center for Operations Research and Econometrics (CORE). I thank my promotors, Peter Boswijk and Sébastien van Belleghem, for all the talks, discussions, and the candidness. I also thank Maurice Bun for his patience in going through the manuscript. They have decided to trust me and I hope I was able to deliver. I also thank my doctoral committee for taking the time to read my manuscript. Their comments have been useful in rethinking about the approaches I considered in the thesis. Let me also single out members of my doctoral committee – Geert Dhaene, Shakeeb Khan, and Frank Kleibergen, for their support in my job search.

Second, I thank all the people who have attended my talks or listened to my ideas (either forced or of their own volition). Let me single out people who have offered some perspective through their comments – Luc Bauwens, Stéphane Bonhomme, Simon Broda, Martin Carree, Pavel Čížek, Geert Dhaene, Firmin Doko Tchato, Jianqing Fan, Kees Jan van Garderen, Noud van Giersbergen, Refet Gürkaynak, Christian Hafner, Harry Haupt, Artūras Juodis, Shakeeb Khan, Jan Kiviet, Frank Kleibergen, Thierry Magnac, Michael Massmann, Salvador Navarro, Serena Ng, Cavit Pakel, Dale Poirier, Renata Rabovič, Douglas Steigerwald, Martin Weidner, Frank Windmeijer, and Jeffrey Wooldridge. I also thank Roy van der Weide for sharing the data used in Chapter 5.

Third, I thank all my friends for their support, even if I am usually not around. Most of my friends are back home in the Philippines and I thank them for making my return home so much fun. I also thank the EDEEM cohort for their help in administrative matters.

Fourth, the support staff at UvA and CORE have made smooth transitions possible. Arnold van Meteren was one of my earliest contacts at UvA. He was responsible for facilitating my long-stay visa application in the Netherlands. José Kiss was very helpful in facilitating accommodation in Amsterdam and registration at the UvA. Kees Nieuwland made office life smoother by being there for computer-related issues. Jolanda Vroons also took his place as IT liaison and was very quick to respond. Evelien Brink, Ana Colic, Wilma de Kruijf, and Robert Helmink are always there to

help whenever I would need assistance. Marc van Steekelenburg has been helpful in dealing with renewing my residence permit. Catherine Germain is possibly one of the best multi-taskers I have ever seen in action. She helped in smoothing out my move to Belgium, dealing with French-speaking authorities, and expediting the final activities of the dissertation defense phase. Marie-Hélène Chassagne has also been very helpful with these final activities as well. Raphaël Tursis was one of the nicer IT guys I have met. I also thank Caroline Dutry, the only support staff at the coordinating institution of the doctoral programme, for dealing with both administrative and finance-related issues. The support staff is really the heart of any institution!

Fifth, I thank the reader of this thesis. I hope you enjoy reading this work just as I have enjoyed (though not without heartbreak) working on it. In case you did not notice, the last few pages of the dissertation are blanks meant for notes.

Finally, I thank my mother for understanding the nature of what I have been doing for the past years, despite her initial hesitations. I thank my brother and sister for being there with my mother in my absence. Although infuriating at times, I would like to thank the cats and our lone dog back in our house, as they have stabilized the household. I thank my better half Stephanie for being one of the constants in my life.



# Contents

<b>1</b>	<b>Introduction</b>	<b>1</b>
1.1	The promise of panel data . . . . .	1
1.2	Sketching some of the arguments . . . . .	4
1.3	How should we respond? . . . . .	18
<b>2</b>	<b>On IV estimation of a dynamic linear probability model with fixed effects</b>	<b>21</b>
2.1	Introduction . . . . .	21
2.2	A situation where the LPM is a good idea . . . . .	23
2.3	Main results . . . . .	25
2.3.1	The case of three time periods . . . . .	25
2.3.2	Large- $T$ case . . . . .	28
2.4	Practical implications . . . . .	30
2.5	Concluding remarks . . . . .	34
2.6	Appendix . . . . .	34
<b>3</b>	<b>Simultaneous equations models for discrete outcomes: Coherence and completeness using panel data</b>	<b>39</b>
3.1	Introduction . . . . .	39
3.2	A stylized example . . . . .	41
3.2.1	Coherence and completeness . . . . .	41
3.2.2	Why a cross section is not enough . . . . .	45
3.2.3	Why panel data may be useful . . . . .	47
3.3	The model . . . . .	48
3.3.1	Background . . . . .	48
3.3.2	Identification . . . . .	50
3.3.3	Estimation and inference . . . . .	54
3.4	Revisiting the results of HI (1995; 2007) . . . . .	57
3.4.1	Similarities and differences . . . . .	57
3.4.2	Results . . . . .	58
3.5	Concluding remarks . . . . .	63
3.6	Appendix . . . . .	64

<b>4</b>	<b>Estimation and inference in dynamic nonlinear fixed effects panel data models by projection</b>	<b>73</b>
4.1	Introduction . . . . .	73
4.2	The projection approach . . . . .	76
4.2.1	Concept . . . . .	76
4.2.2	Implications . . . . .	78
4.2.3	Computation . . . . .	80
4.2.4	Examples . . . . .	83
4.3	Simulations . . . . .	87
4.4	Concluding remarks . . . . .	92
4.5	Appendix . . . . .	93
<b>5</b>	<b>The role of sparsity in panel data models</b>	<b>109</b>
5.1	Introduction . . . . .	109
5.2	Panel lasso for the linear model . . . . .	111
5.2.1	Setup and notation . . . . .	111
5.2.2	Estimation and inference . . . . .	114
5.2.3	Choice of regularization parameter . . . . .	120
5.3	Monte Carlo . . . . .	122
5.4	Inequality and income growth . . . . .	125
5.5	Concluding remarks . . . . .	127
5.6	Appendix . . . . .	129
<b>6</b>	<b>Summary</b>	<b>135</b>
	<b>Bibliography</b>	<b>137</b>
	<b>Nederlandse Samenvatting (Summary in Dutch)</b>	<b>147</b>