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# James Cook Fellowship “Social Laboratory” Simulation Project

Professor Peter Davis

9<sup>th</sup>. COMPASS Research Colloquium  
Statistics New Zealand  
Wednesday, 29 July 2015

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# James Cook Fellowship “Social Laboratory” Simulation Project

## Preamble - Making Knowledge Claims

- The Year of Evaluation – RCTs
- Impact of societal inequality
- Improving inference with better design
- The simulation approach



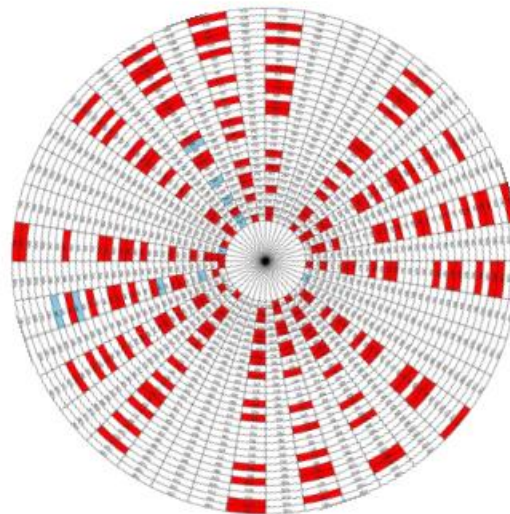
# 2015 International Year of Evaluation

## Identifying What Works

*Using Randomised Control Trials in Public Policy*

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### Symposium Outline



MINISTRY OF SOCIAL  
DEVELOPMENT  
TE MOKATI WHAKAREATO 204



Institute for Governance  
and Policy Studies  
A research institute of the School of Business

# Addressing Inequalities: Views from the Coalface

An interactive discussion forum with the authors of *The Spirit Level*  
Tuesday 20 May, 3–4.30pm, Tāmaki Campus



*The Spirit Level: Why Equality is Better for Everyone* won the 2011 Political Studies Association Publication of the Year Award and the 2010 Bristol Festival of Ideas Prize. It was shortlisted for Research Project of the Year 2009 by the Times Higher Education Supplement, and chosen as one of the Top Ten Books of the Decade by the New Statesman.

## Discussion forum

Join authors Professors Richard Wilkinson and Kate Pickett as they discuss and respond to issues related to inequalities in Population Health.

The discussion forum will be facilitated by Professor Shanthi Ameratunga.

Panel speakers include:

- Associate Professor Chris Bullen (National Institute for Health Innovation)
- Dr Maire Harwood (Māori Health)
- Professor Diana Lannon (Department of Paediatrics: Child and Youth Health)
- Dr Siniva Sinclair (Counties Manukau DHB)
- Associate Professor Susan St John (Department of Economics)
- Dr Tim Tenbensele (Health Systems, Health policy)

## Venue

Tāmaki Campus Building 722, Room 201

This free event is hosted by the School of Population Health.

Refreshments provided at conclusion of event.

## Sir Douglas Robb Lectures

### The Human Cost of Inequality

A series of three lectures by Kate Pickett and Richard Wilkinson

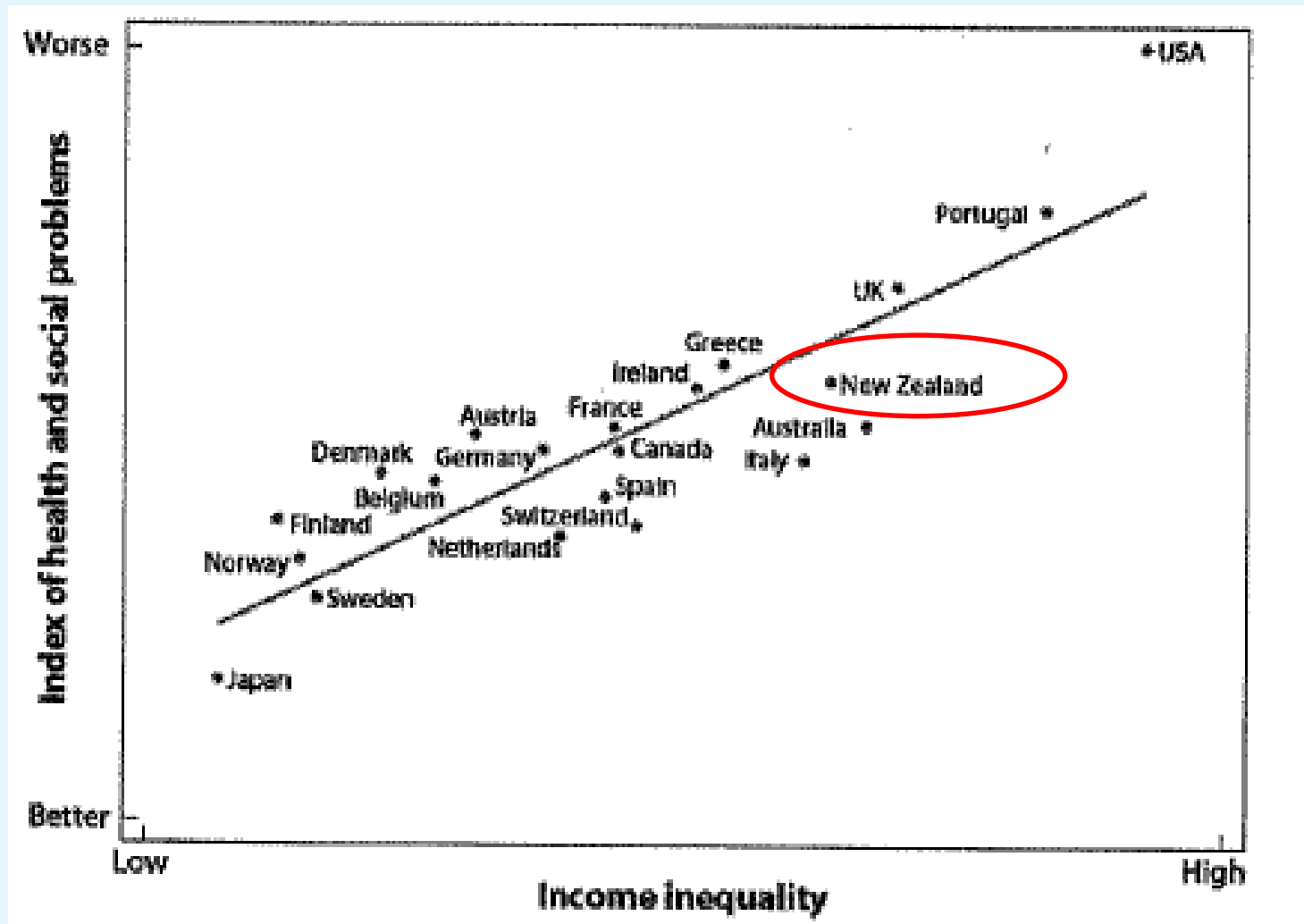
19, 21 and 23 May, 7.30pm

Fisher & Paykel Appliances Auditorium  
Owen G Glenn Building, Grafton Road

For further information visit  
[www.auckland.ac.nz/robb](http://www.auckland.ac.nz/robb)



# Pickett and Wilkinson, Soc Sci Med 2015





# Pickett and Wilkinson, Soc Sci Med 2015

Social Science & Medicine 128 (2015) 316–326



Contents lists available at ScienceDirect

Social Science & Medicine

journal homepage: [www.elsevier.com/locate/socscimed](http://www.elsevier.com/locate/socscimed)



Review

## Income inequality and health: A causal review

Kate E. Pickett<sup>a,\*</sup>, Richard G. Wilkinson<sup>b</sup>

<sup>a</sup> Department of Health Sciences, University of York, York, UK

<sup>b</sup> Division of Epidemiology and Public Health, University of Nottingham, Nottingham, UK



### ARTICLE INFO

Article history:

Available online 30 December 2014

Keywords:

Income distribution

Review

Population health

Causality

### ABSTRACT

There is a very large literature examining income inequality in relation to health. Early reviews came to different interpretations of the evidence, though a large majority of studies reported that health tended to be worse in more unequal societies. More recent studies, not included in those reviews, provide substantial new evidence. Our purpose in this paper is to assess whether or not wider income differences play a causal role leading to worse health. We conducted a literature review within an epidemiological causal framework and inferred the likelihood of a causal relationship between income inequality and health (including violence) by considering the evidence as a whole. The body of evidence strongly suggests that income inequality affects population health and wellbeing. The major causal criteria of temporality, biological plausibility, consistency and lack of alternative explanations are well supported. Of the small minority of studies which find no association, most can be explained by income inequality being measured at an inappropriate scale, the inclusion of mediating variables as controls, the use of subjective rather than objective measures of health, or follow up periods which are too short.

The evidence that large income differences have damaging health and social consequences is strong and in most countries inequality is increasing. Narrowing the gap will improve the health and wellbeing of populations.

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# Avendano article, Soc Sci Med 2012



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Whare Wānanga o Tāmaki Makaurau

Social Science & Medicine 75 (2012) 754–760



Contents lists available at SciVerse ScienceDirect

Social Science & Medicine

journal homepage: [www.elsevier.com/locate/socscimed](http://www.elsevier.com/locate/socscimed)



Short report

## Correlation or causation? Income inequality and infant mortality in fixed effects models in the period 1960–2008 in 34 OECD countries

Mauricio Avendano<sup>a, b, c, \*</sup>

<sup>a</sup>London School of Economics and Political Science, ISE Health and Social Care, London, UK

<sup>b</sup>Center for Population and Development Studies, Harvard School of Public Health, Cambridge, MA, USA

<sup>c</sup>Department of Public Health, Erasmus Medical Center, Rotterdam, The Netherlands

### ARTICLE INFO

**Article history:**  
Available online 11 May 2012

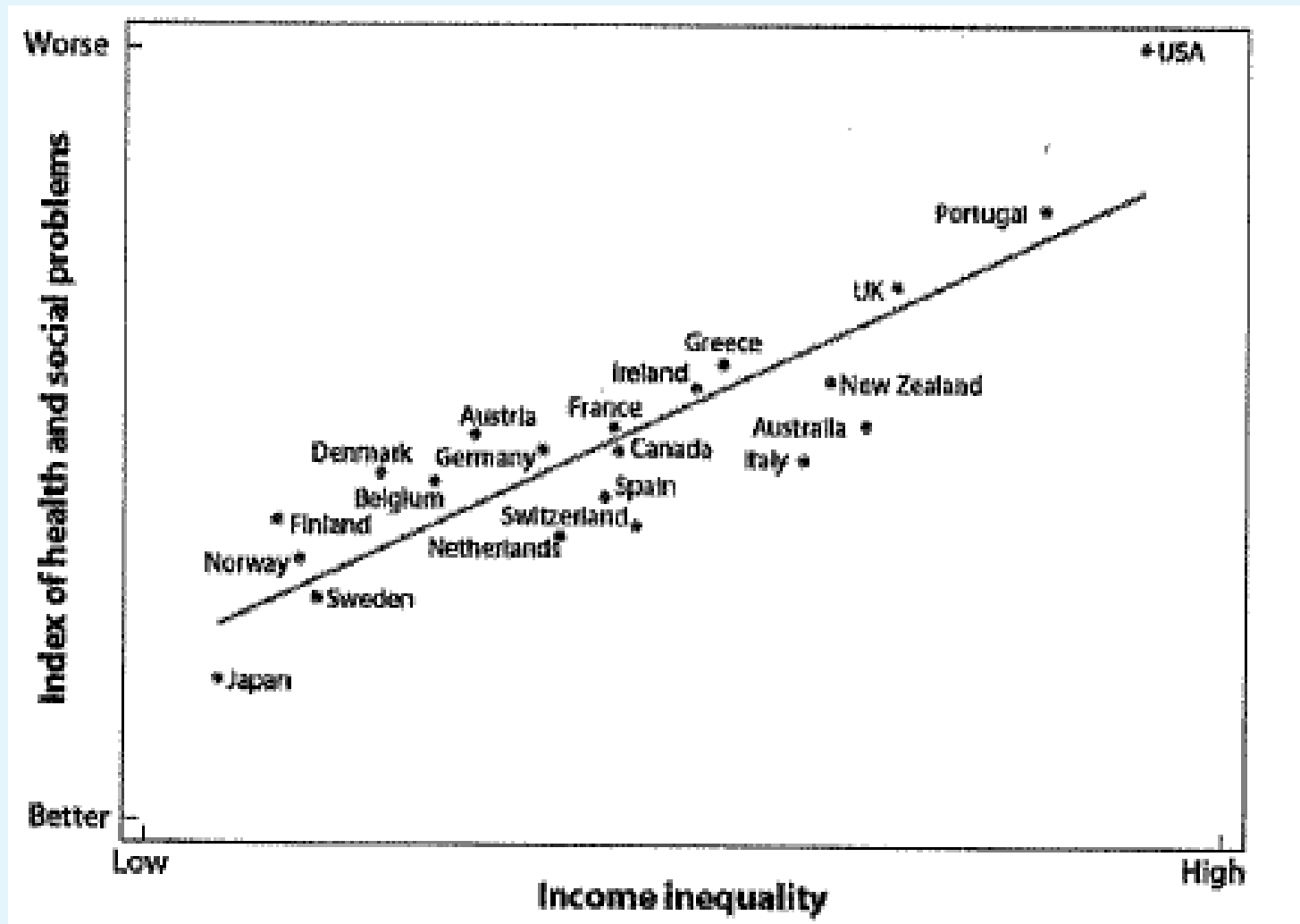
**Keywords:**  
Infant mortality  
Income inequality  
Socioeconomic  
Population health  
Social policy

### ABSTRACT

Income inequality is strongly associated with infant mortality across countries, but whether this association is causal has not been established. In their commentary in this issue of *Social Science & Medicine*, Regidor et al. (2012) argue that this association has disappeared in recent years, and question the premise of a causal link. This paper empirically tests the impact of income inequality on infant mortality in a fixed effects model that exploits the evolution of income inequality over a 38-year period, controlling for all time-invariant differences across countries. Data came from the Standardized World Income Inequality Database, containing yearly estimates for the period 1960–2008 in 34 countries member of the Organization for Economic Co-operation and Development (OECD), linked to infant mortality data from the OECD Health database. Infant mortality was modelled as a function of income inequality in a country and year fixed effects model, incorporating controls for changing economic and labour conditions. In a model without country fixed effects, a one-point increase in the Gini coefficient was associated with a 7% increase in the infant mortality rate (Rate ratio (RR) = 1.07, 95% Confidence Interval [CI] 1.04, 1.09). Controlling for differences across countries in a country fixed effects model, however, income inequality was no longer associated with infant mortality (RR = 1.00, 0.98, 1.01). Similar results were obtained when using lagged values of income inequality for up to 15 years, and in models that controlled for changing labour and economic conditions. Findings suggest that in the short-run, changes in income inequality are not associated with changes in infant mortality. A possible interpretation of the discrepancy between cross-country correlations and fixed effects models is that social policies that reduce infant mortality cluster in countries with low income inequality, but their effects do not operate via income. Findings highlight the need to examine the impact of more specific social policies on infant mortality.

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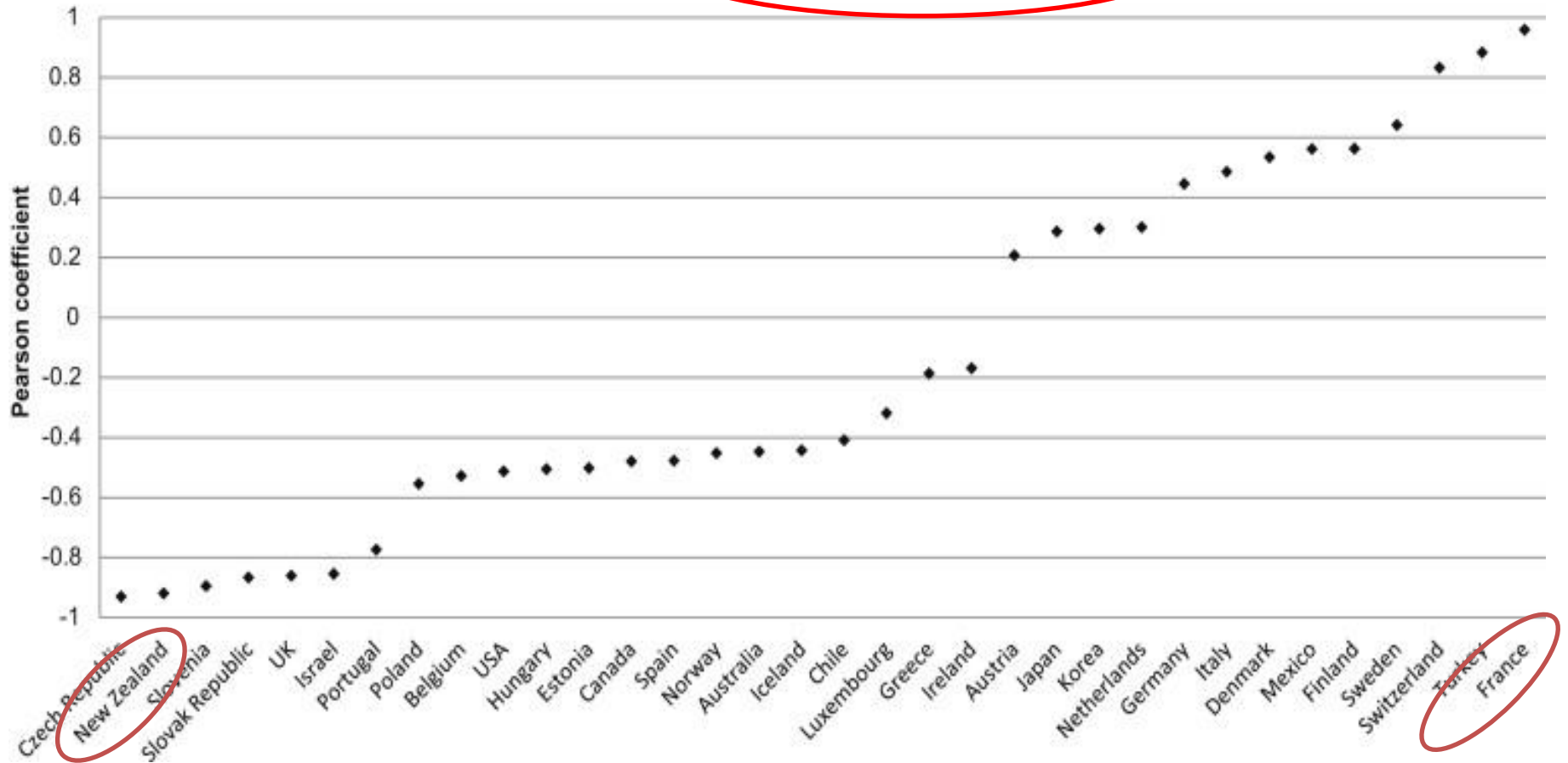
# Pickett and Wilkinson, Soc Sci Med 2015





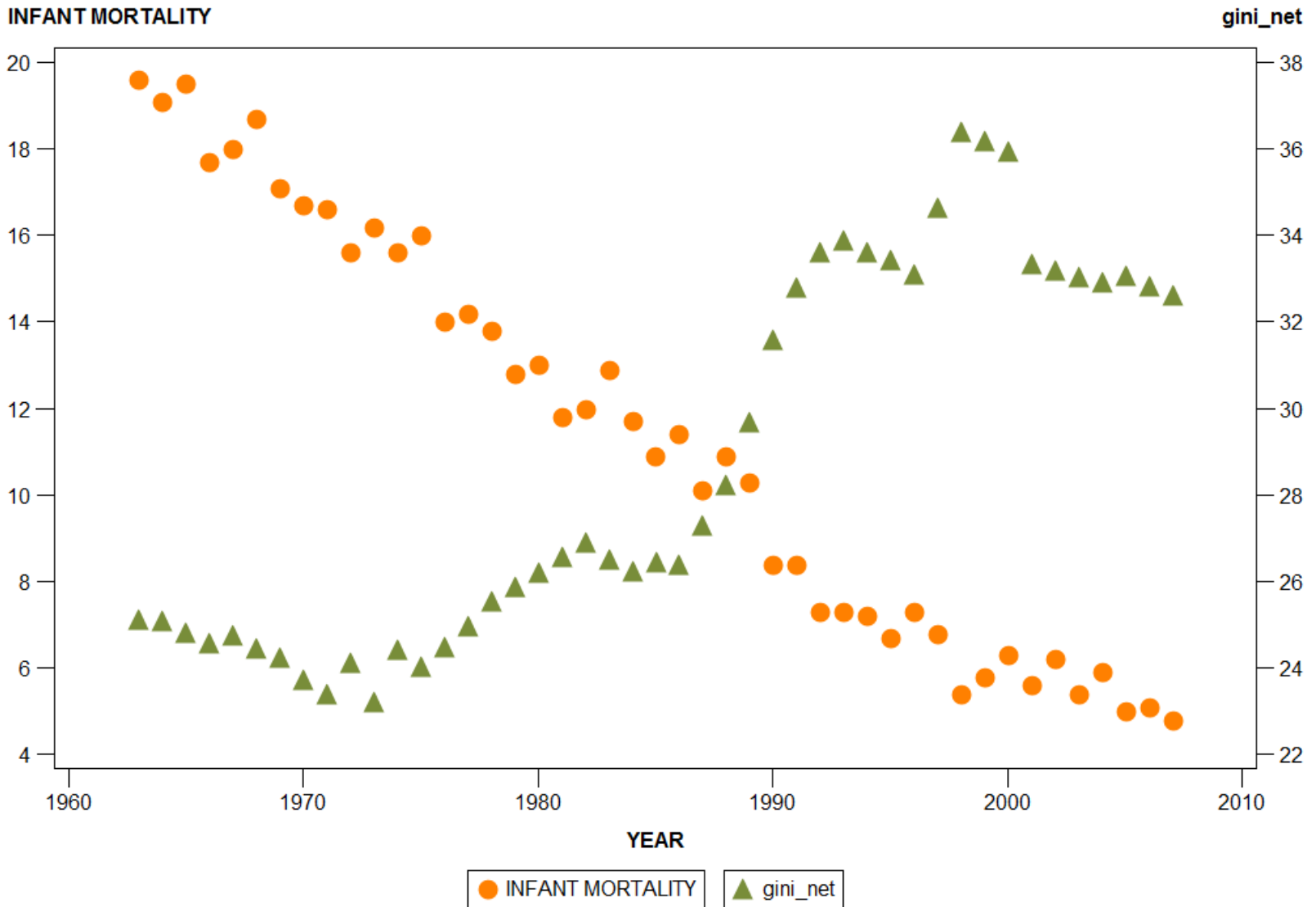
# Avendano 2012

Year-to-year correlation: Income inequality and infant mortality, 1960-2009



# New Zealand

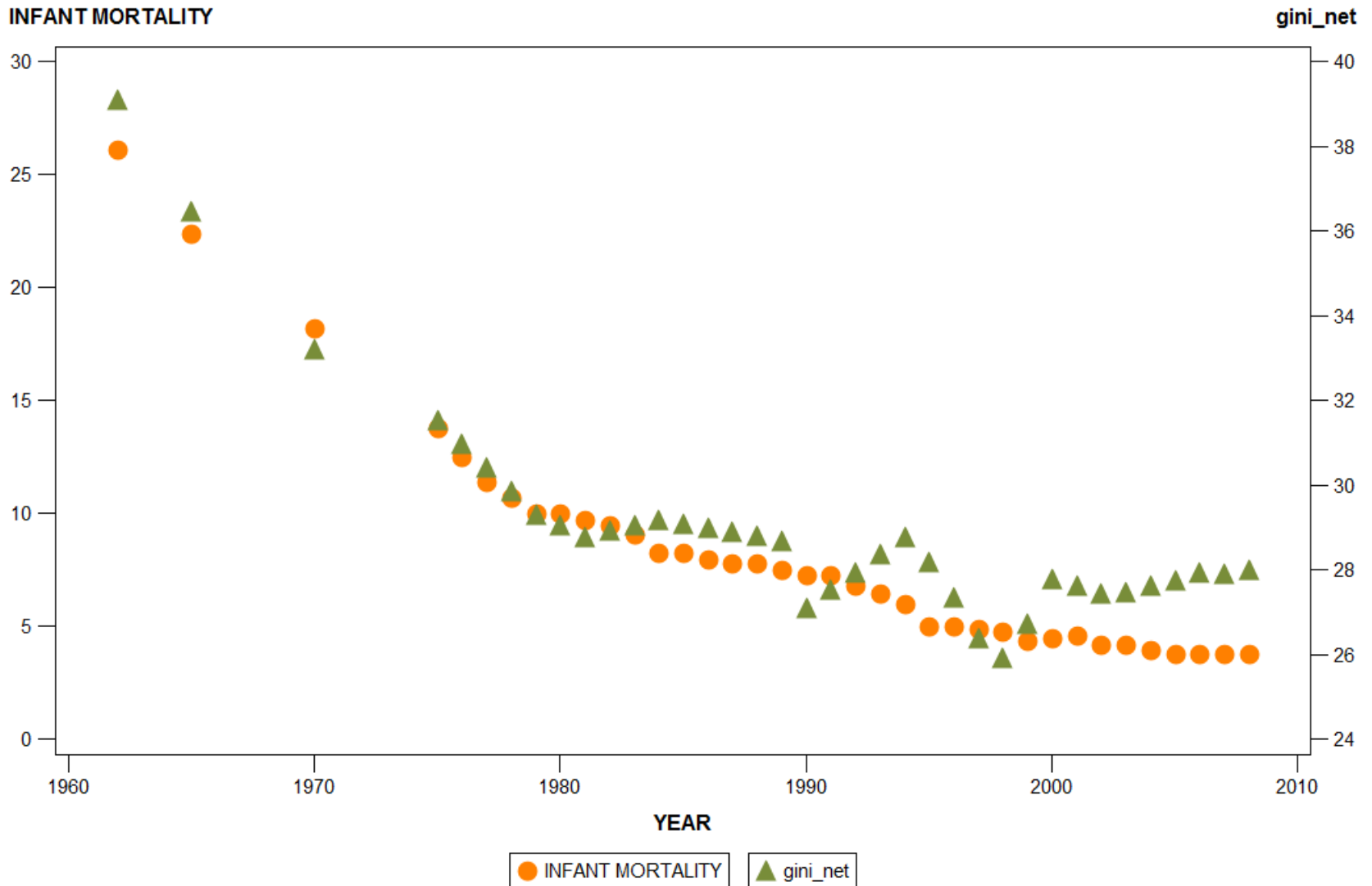
Correlation = -0.92



Source: Avendano data

# France

Correlation = +0.96



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# Causal Inference in Observational Settings



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7<sup>th</sup> Wellington Colloquium

Statistics NZ

30 August 2013

Professor Peter Davis

University of Auckland, New Zealand  
and COMPASS Research Centre

[www.compass.auckland.ac.nz](http://www.compass.auckland.ac.nz)



DATA INFERENCE  
IN OBSERVATIONAL  
SETTINGS

VOLUME I

SAGE BENCHMARKS IN  
SOCIAL RESEARCH METHODS

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VOLUME I

SAGE BENCHMARKS IN  
SOCIAL RESEARCH METHODS

PRESENTED BY  
UNIVERSITY OF MICHIGAN NETWORK ON  
INEQUALITY, COMPLEXITY & HEALTH

**FEBRUARY 24-25, 2014**

Natcher Conference Center  
NIH Campus | Bethesda, MD

**COMPLEX SYSTEMS,  
HEALTH DISPARITIES &  
POPULATION HEALTH:  
BUILDING BRIDGES**



National Institutes of Health  
Office of Behavioral and Social Sciences Research





# Assessing policy counterfactuals with a simulation-based inquiry system.



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Peter Davis and Colleagues  
COMPASS Research Centre  
University of Auckland  
New Zealand

[www.compass.auckland.ac.nz](http://www.compass.auckland.ac.nz)



MINISTRY OF BUSINESS,  
INNOVATION & EMPLOYMENT  
HIKINA WHAKATUTUKI

**DISCLAIMER:** Access to the data used in this study was provided by Statistics New Zealand under conditions designed to give effect to the security and confidentiality provisions of the Statistics Act 1975. The results presented in this study are the work of the author, not Statistics New Zealand.



## ❑ Counterfactual paradigm of causal reasoning

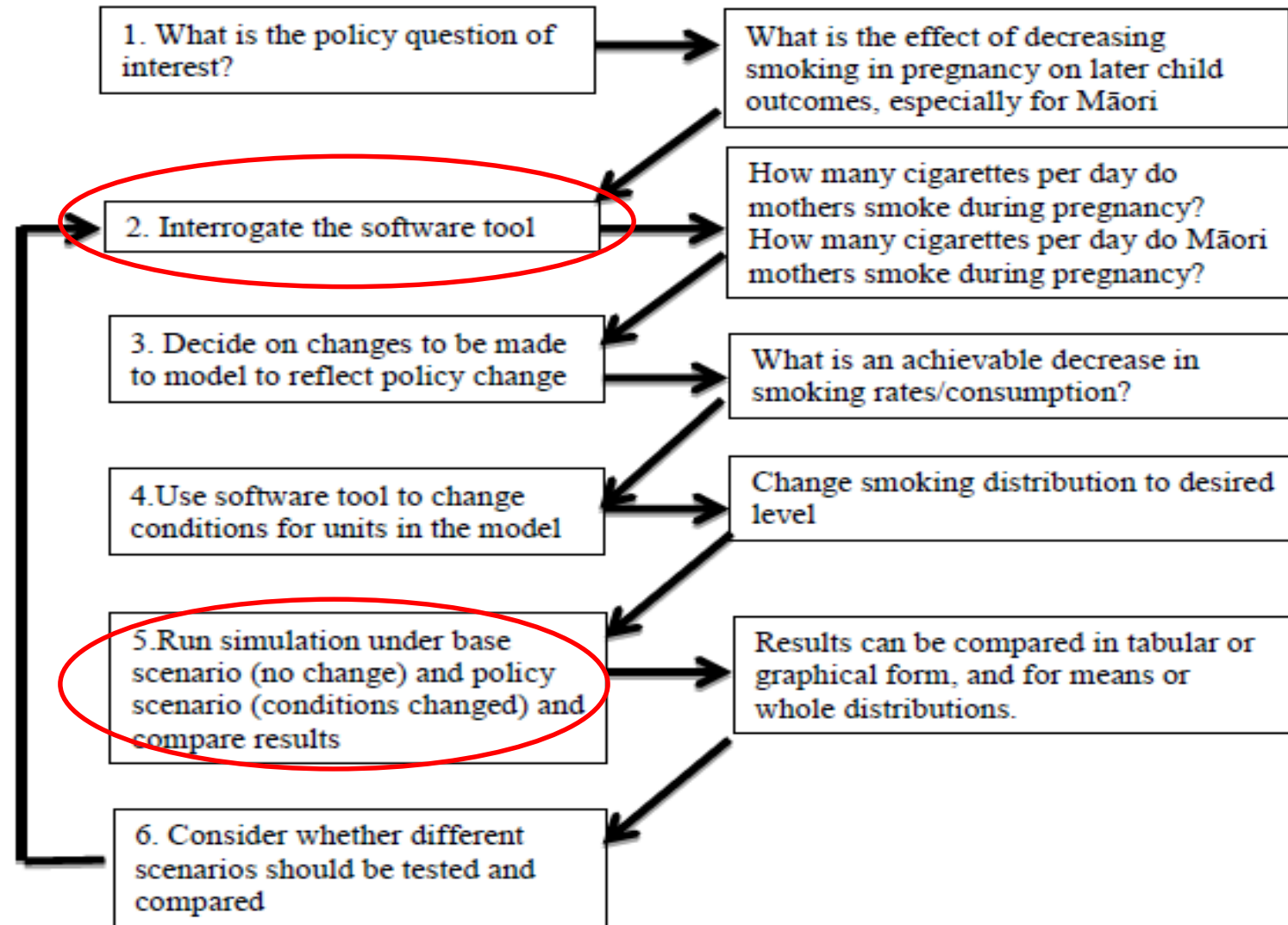
❑ If the putative causal factor had not been present, we would not have observed the recorded outcome.

- Randomised Controlled Trials (RCTs)
- Experimental and quasi-experimental methods
- Observational designs and statistical analysis

❑ **Simulation techniques**



# Inquiry Tool



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ANY QUESTIONS AT THIS POINT!?

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# James Cook Fellowship “Social Laboratory” Simulation Project

## Assessing Counterfactuals about Society

- Background and concept
- Central ingredients of project
- COMPASS team contribution
- Building blocks
- Book proposal

# Outline



- Background
- Central ingredients of the James Cook
- COMPASS team contribution
- Building blocks
  - New Zealand Longitudinal Census (1981-2013)
  - Synthetic base file
  - Estimating equations
  - Open-source micro-simulation platform
- Book proposal

# Background – assessing counterfactuals

- New Zealand, an early policy pioneer
  - 1890-1920 seen by observers as “social laboratory”
  - Social policies tried out by reforming governments
  - A “natural experiment” in a new, fluid society
- How to draw credible inferences about policy?
  - RCTs, experimental and quasi-experimental designs
  - Non-experimental work (e.g. case studies)
  - Virtual “experiments”, using simulation techniques
  - Any precedents? Think of climate change scenarios



# Central Ingredients of James Cook

- Three aims
  - Create model of NZ pop via synthetic cohort
  - Statistical model from NZLC to generate cohorts
  - Conduct experiments, “virtual counterfactuals”
- 1. Constructing smaller, synthetic cohorts
  - Need synthetic starting file for each cohort, 1981
- 2. Estimating statistical model driving cohorts
  - Method for reproducing biographical trajectories
- 3. Testing “virtual counterfactuals”
  - Particular interest in impact of social assets

# Three “Virtual Counterfactuals”

- Health impact of 1980s/1990s restructuring
  - Blakely et al. use a cross-comparative counterfactual (Norway)
  - We can try returning key exogenous parameters to the long-term pre-disruption trend line
  - Assess impact on health inequalities
- Long-term impact of “Working For Families”
  - What would have happened had “normal” settings applied?
  - Did the in-work tax credit work against the poor?
- Impact of social assets on valued goals and outcomes
  - Determine relationship of assets (e.g. social and cultural capital) to achievement of valued goals and outcomes
  - Alter distribution of these non-monetary assets to assess impact

# Senior RF - Barry Milne



## Research-Policy Collaboration – Published 2014



### A collaborative approach to bridging the research-policy gap through the development of policy advice software

Barry John Milne, b.milne@auckland.ac.nz  
Roy Lay-Yee, r.layyee@auckland.ac.nz  
Jessica McLay, jessica.mclay@auckland.ac.nz  
University of Auckland, New Zealand  
Martin Tobias, martin\_tobias@moh.govt.nz  
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Janet Pearson, je.pearson@auckland.ac.nz  
Oliver Mannion, o.mannion@auckland.ac.nz  
Peter Davis, pb.davis@auckland.ac.nz  
University of Auckland, New Zealand

We have developed a software-based tool to support a dynamic micro-simulation model of life-course development (to age 13) as an aid to policy makers assessing the impact of policies affecting children. We demonstrate how this approach bridges the research-policy gap by creating: (1) an easy transfer of evidence in a form that policymakers can use (for example, 'What is the policy influence of X on Y?'); and (2) a 'pull' system of knowledge transfer by which policy makers control the knowledge they access. The advantage of close collaboration with policy makers in the development and implementation phases is also discussed.

IP: 130.216.22.111 On: Mon, 13 Apr 2015 21:27:38  
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# Senior RF – Roy Lay-Yee



## ❑ Determinants and Disparities – Published 2015

Determinants and disparities: A simulation approach to the case of child health care



Roy Lay-Yee\*, Barry Milne, Peter Davis, Janet Pearson, Jessica McLay

*Centre of Methods and Policy Application in the Social Sciences, Faculty of Arts, University of Auckland, New Zealand*



### ARTICLE INFO

#### Article history:

Available online 17 January 2015

#### Keywords:

New Zealand  
Children  
Health care  
Social determinants  
Disparities  
Micro-simulation

### ABSTRACT

Though there is much agreement on the importance of the social determinants of health, debate continues on suitable empirically-based models to underpin efforts to tackle health and health care disparities. We demonstrate an approach that uses a dynamic micro-simulation model of the early life course, based on longitudinal data from a New Zealand cohort of children born in 1977, and counterfactual reasoning applied to a range of outcomes. The focus is on health service use with a comparison to outcomes in non-health domains, namely educational attainment and antisocial behaviour. We show an application of the model to test scenarios based on modifying key determinants and assessing the impact on putative outcomes. We found that appreciable improvement was only effected by modifying multiple determinants; structural determinants were relatively more important than intermediary ones as potential policy levers; there was a social gradient of effect; and interventions bestowed the greatest benefit to the most disadvantaged groups with a corresponding reduction in disparities between the worst-off and the best-off. Our findings provide evidence on how public policy initiatives might be more effective acting broadly across sectors and across social groups, and thus make a real difference to the most disadvantaged.

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# Statistician – Jessica McLay



## ■ Regression Estimation for Dynamic Microsimulation (McLay et al.)

- ACCEPTED WITH REVISIONS (International Journal of Microsimulation)

**Abstract:** Microsimulation models seek to represent real-world processes and can generate extensive amounts of synthetic data. Most often, the parameters that drive the data generation process are estimated by statistical modelling techniques, such as regression. But which techniques are best suited to this purpose? We assess the performance of five regression-style estimation techniques: ordinary least squares regression with a lagged dependent variable, random effects with and without an autoregressive order 1 within-unit error structure, a hybrid model combining features from both econometric fixed effects and random effects models, and a dynamic panel model estimated with system generalised method of moments. The criterion for good performance was the proximity of fit of simulated data to empirical data on various characteristics. It was found that ordinary least squares regression with a lagged dependent variable out-performed the other techniques. Random effects with autoregressive errors of the first order was the next best, followed by standard random effects. The dynamic panel model came fourth followed by the hybrid model. This empirical assessment provides practical guidance to those contemplating dynamic microsimulation and other applications using regression-style techniques of synthetic data generation.

# Outline



- ~~Background~~
- ~~Central ingredients of the James Cook~~
- ~~COMPASS team contribution~~
- Building blocks
  - New Zealand Longitudinal Census (1981-2013)
  - Synthetic base file
  - Estimating equations
  - Open-source micro-simulation platform
- Book proposal



## Linking censuses

New Zealand longitudinal census 1981–2006

Robert Didham, Kirsten Nissen, and Wendy Dobson





## 2006 Census birth cohort SURF

### Sections on this page

[About the birth cohort SURF](#)

[About the 2006 Census](#)

[Using the birth cohort SURF](#)

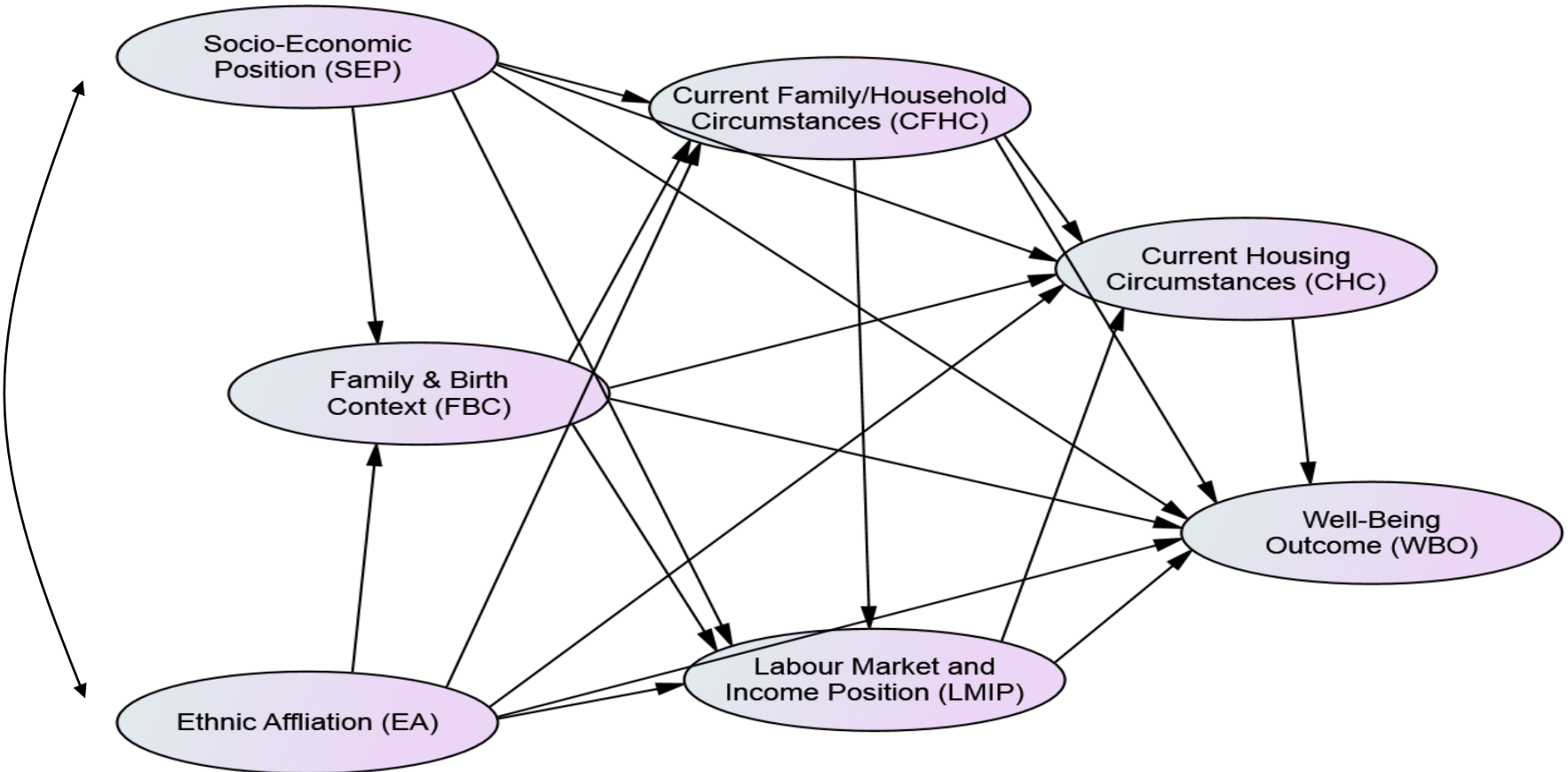
[Interpreting the variables](#)

### Available files

[2006 Census birth cohort SURF](#) (Excel, 1 sheet, 3.67MB)

[2006 Census birth cohort SURF data dictionary](#) (Excel, 1 sheet, 17kB)

# Cohort Estimating Equations



# Open-Source Simulation Software

## License And Copyright

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### Contents [\[hide\]](#)

- [1 OpenM++ is a Free and Open Source Software](#)
- [2 OpenM++ License](#)
- [3 Contribute to OpenM++](#)
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- [5 Usage of other software in OpenM++](#)
  - [5.1 Build Files](#)

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- [Wiki article on MIT License](#) 

# Book Proposal



233 Spring Street  
New York, NY 10013

## *BOOK PROPOSAL*

**\*THIS WILL BE AN (SELECT ONE) AUTHORED WORK.**

**\*WORKING TITLE OF YOUR BOOK:**

**The COMPASS policy “collaboratory”**

**\*SUBTITLE:**

**A simulation-based system for cooperative social inquiry**

# Central Ingredients of James Cook

- Three aims
    - Create model of NZ pop via synthetic cohort
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QUESTIONS, COMMENTS!