JCU ePrints

This file is part of the following reference:

Crossman, Peter John (1981) ***The gross state product and an econometric model of the state of Queensland.*** **PhD thesis, James Cook University**.

Access to this file is available from:

http://eprints.jcu.edu.au/121767

JCU
JAMES COOK UNIVERSITY

THE GROSS STATE PRODUCT AND AN ECONOMETRIC MODEL OF THE STATE OF QUEENSLAND

Thesis submitted by

Peter John CROSSMAN, B.Ec.

in June 1981

for the Degree of Doctor of Philosophy in
the Department of Economics at the
James Cook University of North Queensland

STATEMENT OF ACCESS

I, the undersigned author of this work, understand that James Cook University will make this thesis available for use within the University Library and, via Australian Research Online, for use elsewhere.

I understand that, as an unpublished work, a thesis has significant protection under the Copyright Act and;

I do not wish to place any further restriction on access to this work

Or

I wish this work to be embargoed until

Or

I wish the following restrictions to be placed on this work:

_____ _____

Name (please print) **Signature**

_____

Date

ABSTRACT

With regard to the economic features of the Australian federation, it is becoming evident that two matters will stimulate increasing investigation and analysis over the next decade. The first of these matters is the study of the economic performance of the individual states, given the move towards greater autonomy of the states in many functional areas and greater reliance on their own sources of revenue. The second of these matters is the study of the interactions between the economies of the nation and the individual states, particularly the impact of federal government decisions on the states. This thesis is a contribution to the first of these developments, and seeks to make a contribution to the regionally disaggregated view of macro-econometrics, in the context of Australia.

This thesis has the objective of determining answers to two questions. Firstly, using existing data sources, both published and unpublished, is it possible to construct a reasonably accurate and disaggregated set of estimates of gross state product for Queensland? Secondly, is it then possible to construct a macro-econometric type regional econometric model of the State of Queensland, using these gross product estimates?

The first question has been answered in this thesis by developing a set of quarterly estimates of the gross state product at factor cost of Queensland, for forty quarters from September 1969 to June 1979, disaggregated by ASIC industry division and by principal component, using payroll tax tabulations as the basic data source. The method of estimation is an improvement over other recent gross state product estimation, both in Australia and overseas.

Since much state economic data are available only on an annual basis, a method of interpolating quarterly values from annual values of economic series was chosen and improved. The second question was then answered by specifying a quarterly regional econometric model for Queensland based, as much as possible, on the general specification of Klein (1969). This model was then estimated by ordinary least squares and two stage least squares with principal components, and a number of exploratory dynamic simulations were performed.

TABLE OF CONTENTS

Abstract		iii
List of Tables		viii
List of Figures		xii
Declaration		xiv
Acknowledgments		xv
Abbreviations		xvi
Chapter		
1	INTRODUCTION	1
	1.1 THE PURPOSE OF THIS STUDY	1
	1.2 THE SETTING OF THIS STUDY	3
	1.3 AN OUTLINE OF THIS STUDY	7
2	REGIONAL ECONOMETRIC MODELS	9
	2.1 ECONOMETRIC MODELS	9
	2.2 THE CASE FOR REGIONAL ECONOMETRIC MODELS	13
	2.3 REGIONAL ECONOMIC MODELS	23
	2.4 A SURVEY OF SELECTED REGIONAL ECONOMETRIC MODELS	30
	2.4.1 An overall survey	30
	2.4.2 An analysis of the selected models	37
	2.5 AN ASSESSMENT OF EXISTING REGIONAL ECONOMETRIC MODELS	77
	2.6 IMPLICATIONS FOR THE SPECIFICATION OF AN ECONOMETRIC MODEL OF QUEENSLAND	83
3	THE GROSS STATE PRODUCT OF QUEENSLAND	86
	3.1 THE IMPORTANCE OF GSP	86
	3.2 METHODS OF ESTIMATION OF GSP	90
	3.3 A SURVEY OF GSP ESTIMATION	92
	3.3.1 GSP Estimation in the USA	93

Chapter

	3.3.2 GSP Estimation in Canada	100
	3.3.3 GSP Estimation in the UK	102
	3.3.4 GSP Estimation in Australia	107
3.4	ESTIMATION OF QUEENSLAND GSP	123
	3.4.1 Broad Outline of the Method	123
	3.4.2 Abbreviations and Notation	127
	3.4.3 The Computerized Estimation System	127
	3.4.4 Quarterly and Industrial Breakdowns	131
	3.4.5 Direct Insertion from Official Sources	132
	3.4.6 Public Sector WS Estimation	141
	3.4.7 Supplements Estimation	145
	3.4.8 Payroll Tax Tabulation WS Estimates	146
	3.4.9 Total WSSQ by Industry and Quarter	152
	3.4.10 Ownership of Dwellings Estimation	157
	3.4.11 Imputed Bank Service Charge Estimation	158
	3.4.12 Allocation of GOS by National Ratios	160
	3.4.13 GSP at Factor Cost Estimates by Industry, Quarter and Principal Component	161
3.5	VALIDATION AND CRITICISMS OF THE ESTIMATES	168
	3.5.1 Direct versus Indirect Estimation	168
	3.5.2 Queensland as a Proportion of Australia	168
	3.5.3 The Structure of Queensland Industry	174
	3.5.4 Real Growth in Queensland	178
	3.5.5 Comparison with Naive Estimates	180
	3.5.6 Other Validation	183
3.6	A GENERAL ASSESSMENT OF THE QUALITY OF THE ESTIMATES	187

Chapter

4 DATA FOR A QUARTERLY ECONOMETRIC MODEL OF QUEENSLAND 190

4.1 INTRODUCTION 190

4.2 CONSTRUCTION OF QUARTERLY DATA ESTIMATES 191

4.2.1 Previous Work 191

4.2.2 Outline of the Method 193

4.2.3 Comparison With Other Methods 199

4.2.4 Use in the Queensland Model 201

4.3 GENERAL SOURCES OF DATA 201

4.4 COMPUTERIZED DATA MANAGEMENT 205

5 THE SPECIFICATION AND ESTIMATION OF THE QUEENSLAND ECONOMETRIC MODEL 208

5.1 TOWARDS THE QUEENSLAND MODEL 208

5.2 THE OVERALL STRUCTURE OF THE QUEENSLAND MODEL 212

5.3 THE DETAILED STRUCTURE OF THE QUEENSLAND MODEL 216

5.3.1 Block One: Consumption 216

5.3.2 Block Two: State and Local Government 218

5.3.3 Block Three: External Trade 229

5.3.4 Block Four: Gross State Product at Average 1974-75 Prices 229

5.3.5 Block Five: Gross State Product by Industry 231

5.3.6 Block Six: GSP at Current Prices 232

5.3.7 Block Seven: Prices 235

5.3.8 Block Eight: Employment by Industry 235

5.3.9 Block Nine: Labour Force and Demography 240

5.3.10 Block Ten: Average Wages and Earnings 242

5.3.11 Block Eleven: Wage Rates by Industry 242

5.3.12 Block Twelve: Wages, Salaries and Supplements by Industry 245

Chapter

5.3.13 Block Thirteen: Income 245

Appendix to Chapter 5 QUEENSLAND MODEL DATABANK INDEX 250

6 SIMULATION OF THE QUEENSLAND MODEL 262

6.1 SIMULATION OF NON-LINEAR ECONOMETRIC MODELS 262

6.2 OLS HISTORICAL VALIDATION DYNAMIC SIMULATION 264

6.3 TSPC HISTORICAL VALIDATION DYNAMIC SIMULATION 285

6.4 EX POST FORECAST DYNAMIC SIMULATION 289

6.5 IMPACT AND POLICY SIMULATIONS 289

7 CONCLUSION 299

7.1 AN OVERVIEW OF THIS STUDY 299

7.2 DIRECTIONS FOR FURTHER RESEARCH 302

APPENDIX

A DATA SOURCES FOR QUEENSLAND GSP ESTIMATION 305

B QUEENSLAND AND AUSTRALIA ANNUAL GROSS PRODUCT COMPARISON TABLES 308

C QUARTERLY DATA CONSTRUCTION 339

BIBLIOGRAPHY 341

LIST OF TABLES

Table		Page
1.1	Queensland in relation to Australia	6
2.1	Selected economic indicators, by state	19
2.2	Comparison of rates of real economic growth in Queensland and Australia, 1970-71 to 1978-79	21
2.3	A tabular survey of selected regional econometric models	31
2.4	Cross-classification of the selected model regions by population and area	38
2.5	Outline of the structure of the Czamanski (1968) regional econometric model	71
2.6	Instrument and target variables in the Czamanski (1968) regional econometric model	72
3.1	Queensland and Australian Household Income to Gross Product ratios	88
3.2	Alternative approaches to the estimation of Gross State Product	91
3.3	Selected GSP work in the USA	94
3.4	GSP work in the UK	103
3.5	Previous Australian GSP work	108
3.6	Coghlan's economic accounts of New South Wales, 1894	109
3.7	Arndt and Butlin's economic accounts of New South Wales, 1891	112
3.8	Clark's estimates of national income for Queensland, 1937-38	113
3.9	Kerr's estimates of state income at factor cost by productive sector for Western Australia, 1955-56	115
3.10	Wong's estimate of GSP at factor cost for Tasmania, 1969-70	117
3.11	Hudson's estimates of GSP at market prices by industry for Tasmania, 1969-70	118

Table		Page
3.12	Comparison of Tasmanian GSP estimates, 1962-63 to 1965-66	121
3.13	Donovan's estimates of GSP for Queensland, 1953-54 to 1965-66	122
3.14	Gross domestic product at factor cost by industry and principal components, Australia, 1977-78	125
3.15	Abbreviations used in GSP estimation section	128
3.16	Industries used in this study	133
3.17	Estimates of gross product, by industry and principal component for Queensland and Australia, 1977-78	134
3.18	Gross value of farm production, Queensland, 1977-78	137
3.19	Sugar mill seasons in the 1977 sugar "year"	138
3.20	The sugar commodity quarterly allocators for 1977-78	139
3.21	Industry allocators for WS for non-PAD commonwealth employees	144
3.22	Estimation of CLI to ASIC reconciliation proportions	151
3.23	Wages and salaries measured by payroll tax tabulations, by industry and quarter, Queensland, 1977-78	153
3.24	Exemption limits for payroll tax, Queensland	154
3.25	Small business allocators	155
3.26	Detailed WSSQ estimation, September quarter 1977	156
3.27	Quarterly allocation of gross operating surplus of ownership of dwellings, Queensland, 1977-78	159
3.28	Imputed bank service charge estimation, Queensland, 1977-78	159
3.29	National and IEC-adjusted GOS to WSS ratios for mining, manufacturing and electricity, 1969-70 to 1978-79	162
3.30	National ratios for other industries, 1969-70 to 1978-79	163

Table		Page
3.31	GSP at factor cost by industry, Queensland, 1969 III to 1979 II	164
3.32	Wages, salaries and supplements by industry, Queensland, 1969 III to 1979 II	165
3.33	Gross operating surplus by industry, Queensland, 1969 III to 1979 II	166
3.34	Proportions of direct versus indirect estimation of GSP, Queensland, 1977-78	169
3.35	Queensland GSP as a proportion of Australian GDP, by industry, 1969-70 to 1978-79	170
3.36	Queensland's principal components of gross product as a proportion of Australia's, 1969 III to 1979 II	172
3.37	Per capita principal components of gross product, Queensland and Australia, 1969-70 to 1978-79	173
3.38	Percentage industry contribution to gross product, Queensland, 1969-70 to 1978-79	175
3.39	Rankings of relative size of Queensland industries, 1969-70 to 1978-79	176
3.40	Industry relative specialization quotients for gross product Queensland, 1969-70 to 1978-79	177
3.41	Annual percentage growth in GSP at current prices by industry, Queensland, 1970-71 to 1978-79	179
3.42	Implicit price deflators for Queensland and Australia and GSP at average 1974-75 prices, 1969-70 to 1978-79	181
3.43	Annual percentage growth in GSP and GDP at average 1974-75 prices, 1970-71 to 1978-79	182
3.44	Comparison with naive estimates, GSP, Queensland, 1969-70 to 1978-79	184
3.45	Queensland's share in Australia	185
3.46	Comparison with IEC results	186
3.47	Comparison with Queensland Transactions Matrix results, 1973-74	188
4.1	Comparison of interpolated data statistics	200
4.2	US quarterly GNP and its estimates	202

Table		Page
4.3	ABS publications used as data sources	203
5.1	Industry classification of the Queensland model	211
5.2	Equation blocks of the Queensland model	213
5.3	National accounting framework for the state and local government sector	221
5.4	Policy response effects in the state and local government sector	228
6.1	OLS historical validation dynamic simulation run summary statistics	280
6.2	Distribution of OLS MAPE's	284
6.3	Comparison of OLS and TSPC MAPE's	288
6.4	Ex post forecast results for selected variables	290
6.5	Dynamic multipliers for changes in government expenditures and tax rate	292
6.6	Tax rate policy simulation results	293
6.7	National economic conditions simulation experiment	295
6.8	Freezing of real per capita grants policy simulation experiment	297
6.9	Experimental and benchmark values of GCWCUR$P and GCWCAP$P	298

LIST OF FIGURES

Figure		Page
1.1	The states and territories of Australia	5
2.1	The structure of the IMPACT project	14
2.2	Perspective of the selected models	40
2.3	Klein's specification of an ideal regional macro model	46
2.4	The structure of the Glickman (1971) regional econometric model	52
2.5	Causal flows in the Mississippi model	57
2.6	Causal flows within the Philadelphia model	61
2.7	The structure of the L'Esperance (1977) regional econometric model	64
3.1	Household Income to Gross Product ratios	89
3.2	Flowchart of the programmed GSP estimation system	130
3.3	Flowchart of the processing of the payroll tax tabulations	148
3.4	GSP, WSSQ and GOSQ, Queensland, 1969 III to 1979 II	167
5.1	Causal flows of the Queensland model	215
5.2	Block One (Consumption) equations	217
5.3	Block Two (State and Local Government) equations	223
5.4	Block Three (External Trade) equations	230
5.5	Block Five (GSP by Industry) equations	233
5.6	Block Seven (Prices) equations	236
5.7	Block Eight (Employment by Industry) equations	238
5.8	Block Nine (Labour Force and Demography) equations	241
5.9	Block Eleven (Wage Rates by Industry) equations	243
5.10	Block Twelve (WSS by Industry) equations	246

Figure		Page
5.11	Block Thirteen (Income) equations	249
6.1	Actual and simulated values of gross state product	265
6.2	Actual and simulated values of gross state product at average 1974-75 prices	266
6.3	Actual and simulated values of private final consumption expenditure at average 1974-75 prices	267
6.4	Actual and simulated values of state and local government final consumption expenditure at average 1974-75 prices	268
6.5	Actual and simulated values of state and local government expenditure on new fixed assets at average 1974-75 prices	269
6.6	Actual and simulated values of imports	270
6.7	Actual and simulated values of implicit price deflator for gross non-agricultural product	271
6.8	Actual and simulated values of consumer price index	272
6.9	Actual and simulated values of population	273
6.10	Actual and simulated values of unemployment rate	274
6.11	Actual and simulated values of wages, salaries and supplements	275
6.12	Actual and simulated values of average weekly earnings per employed male unit	276
6.13	Actual and simulated values of federal income taxes	277
6.14	Actual and simulated values of household income	278

DECLARATION

I declare that this thesis is my own work and has not been submitted in any form for another degree or diploma at any university or other institute of tertiary education. Information derived from the published or unpublished work of others has been acknowledged in the text and a list of references is given.

P.J. Crossman
15 June 1981

ACKNOWLEDGMENTS

I would like to thank my supervisors at James Cook University, Professor C.P. Harris and Professor K.P. Stark, for their patient assistance and invaluable advice during the writing of this thesis. Also, Professor Harris is thanked for the pleasant and scholarly climate he has engendered as Head of the Department of Economics - a climate from which I have greatly benefited.

I would also like to record my appreciation of the professional and cheerful advice and excellent computing facilities provided by Mr Ian Hunter, Manager of the James Cook University Computer Centre, and his staff, and also Mr Geoff Duce, and his staff of Administration Data Processing, who provided invaluable assistance in data preparation.

The Australian Bureau of Statistics has been most cooperative. I particularly wish to thank Mr O. May, Deputy Commonwealth Statistician and Queensland State Statistician, and his staff of the Queensland Office, for their constructive comments on this work at various stages and their assistance in the provision of data.

My thanks also go to Professor W. Hogan and Dr C. Clark who were kind enough to read and comment on working papers discussing gross state product estimation, and Dr B. Grewal who was kind enough to comment on several drafts of this thesis. Finally, I thank Mrs Joy Walterson, who typed this thesis. Without her assistance and drive, this thesis would not have been completed on time.

LIST OF ABBREVIATIONS USED

ABS	Australian Bureau of Statistics
EEC	European Economic Community
FEA	Functional economic area
GDP	Gross domestic product
GNP	Gross national product
GSP	Gross state product
IEC	Integrated economic census
MAPE	Mean absolute percent error
NIE	Australian National Accounts: National Income and Expenditure
OLS	Ordinary least squares
SMSA	Standard metropolitan statistical area
TSLS	Two stage least squares
TSPC	Two stage least squares with principal components
UK	United Kingdom
USA	United States of America