

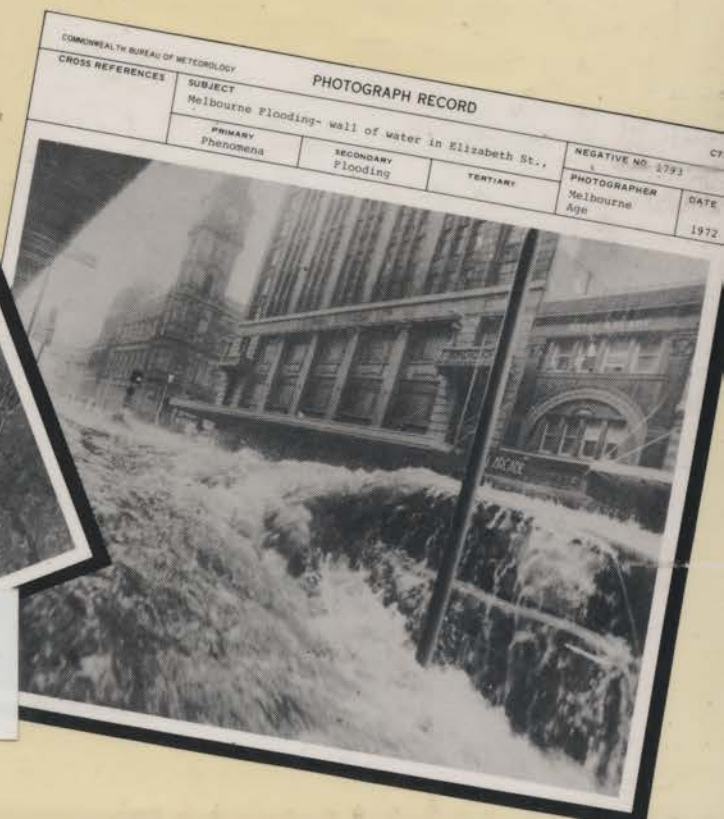
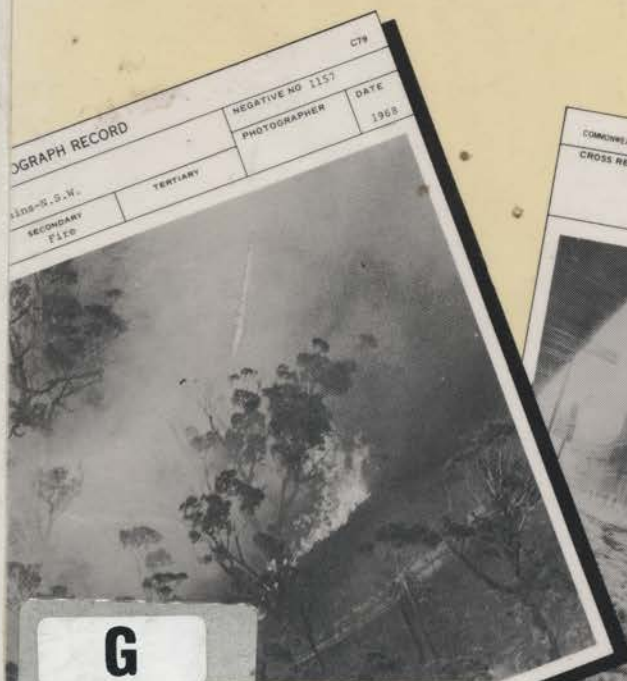
me
M

The economics of natural disaster relief in Australia

JRG Butler and DP Doessel

Centre for Research on Federal Financial Relations
The Australian National University, Canberra

Research Monograph No. 27



G

HV555.A8
.B87

HV555 A8 B87

1663099



A.N.U. LIBRARY

This book was published by ANU Press between 1965–1991.

This republication is part of the digitisation project being carried out by Scholarly Information Services/Library and ANU Press.

This project aims to make past scholarly works published by The Australian National University available to a global audience under its open-access policy.

The economics of natural disaster relief in Australia

**JRG Butler and
DP Doessel**

Research Monograph No. 27

First published in Australia 1979

Printed in Australia for the Centre for Research on Federal
Financial Relations, The Australian National University, Canberra.

© J. R. G. Butler and D. P. Doessel 1979

This book is copyright. Apart from fair dealing for the purposes of private study, research, criticism, or review, as permitted under the Copyright Act, no part may be reproduced by any process without written permission. Inquiries should be made to the publisher.

National Library of Australia
Cataloguing-in-Publication entry

Butler, James Robert Gerard, 1952—
The economics of natural disaster relief in Australia.

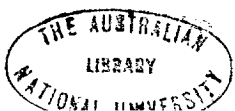
(Australian National University, Canberra. Centre for Research on Federal Financial Relations
Research monograph; no. 27 ISSN 0313-5969)

Bibliography
ISBN 0 7081 1073 8

1. Disaster relief — Australia. 2. Natural disasters — Australia.
1. Doessel, Darrel Phillip, 1945-, joint author. II. Title.
(Series)

361.5'0994

Library of Congress Catalog Card Number 79-50570



FOREWORD

THE CENTRE FOR RESEARCH ON FEDERAL FINANCIAL RELATIONS

The Centre was established by the Australian National University in 1972, with financial support from the Australian Government, for the purpose of undertaking studies in the field of federal financial relations. The role of the Centre is to generate ideas in relation to problems of federal finance and to extend the reliability and range of information and analysis. In particular, the work of the Centre has regard to expenditure responsibilities, financial powers (with respect to both taxation and loan finance), grants arrangements and the scope for intergovernmental co-operation.

The Centre's research program is being directed to four major fields of study:

- (a) financial and economic analysis of the Australian and other federal systems;
- (b) criteria and machinery for determining the allocation of financial resources among governments;
- (c) intergovernmental aspects of urban and regional development; and
- (d) the impact of the federal financial system on the effectiveness of expenditure in major areas such as education.

The Director of the Centre (Professor R. L. Mathews) is advised by a Research Advisory Committee, the membership of which reflects the interests of the Australian, State and local governments and includes members of other universities. Emeritus Professor Sir John Crawford is Chairman of the Committee. Although the Centre's work is concerned especially with intergovernmental financial relationships, the approach is interdisciplinary and involves scholars from the fields of constitutional law, political science and administrative studies as well as economics. The Centre has only a small permanent staff and much of the research program is being carried out by visiting fellows, scholars in other institutions assisted by research grants from the Centre, and postgraduate scholars.

The results of research are being published in books, research monographs, occasional papers and a reprint series (see end pages). Views expressed in the Centre's publications are those of individual authors and no endorsement by the Centre or by the University is implied.

ACKNOWLEDGMENTS

The authors wish to acknowledge the assistance of the numerous public servants with Australian, Queensland and Tasmanian Government Departments who gave generously of their time to assist us on numerous matters of detail discussed in this monograph. Without such assistance the monograph would not have appeared.

Mr W. R. Lane, Reader in Economics at the University of Queensland, kindly read various early drafts in manuscript of the monograph. His advice on numerous matters of fact, theory and interpretation, has been invaluable. We acknowledge also the assistance of Mr W. G. Hayden, M.H.R., and Dr P. T. McCawley of the Australian National University, who in 1974 encouraged one of us (D.P.D.) to undertake an analysis of natural disaster relief. Some of the issues raised in this monograph were discussed at a seminar at the Darling Downs Institute of Advanced Education in 1977. We acknowledge the critical comments of a number of participants in that seminar which led us to reconsider and clarify some issues.

The Economic and Financial Research Fund of the Reserve Bank of Australia assisted the completion of the project by a research grant made available to us in late 1977. This assistance was complemented by Visiting Fellowships to the Australian National University provided by the Centre for Research on Federal Financial Relations. The monograph was substantially completed in the Centre's excellent environment during April-May 1978. Mr M. R. Grenning and Ms A. P. Foster have provided excellent research assistance at different stages of the project, and Mrs Zofia McCormack has persevered with the typing of the numerous drafts of this monograph. However, our greatest debts are to our wives who have had to bear the privations that authorship brings to family life.

Needless to say none of the persons or institutions who have provided us with information or advice is in any way responsible for the contents, arguments or interpretations of this monograph. Responsibility for these matters rests entirely with the authors.

J.R.G.B. and D.P.D.

April, 1979

The Centre for Research on Federal Financial Relations records its appreciation to ANU Graphic Design for designing the cover of this monograph. The Centre also wishes to thank Mrs V. J. Murray for making the necessary arrangements for publication.

R. L. Mathews

April, 1979

CONTENTS

<i>Chapter</i>	<i>Page</i>
Foreword	(v)
Acknowledgments	(vi)
Tables	(ix)
Figures	(xiii)
Charts	(xv)
I INTRODUCTION	1
II NATURAL DISASTER RELIEF IN A FEDERAL SYSTEM	
(1) Theoretical Aspects	6
(2) The Development of Policy on Natural Disasters in Australia	12
(3) Natural Disaster Relief and Vertical Imbalance	22
(4) Horizontal Equalisation and "Base" Expenditures on Natural Disasters	29
III THE QUEENSLAND 1974 FLOOD — DIMENSIONS OF THE DISASTER	
(1) Some Data on Damage	37
(2) Insurance Claims	40
(3) Redistribution by Government	44
(4) Redistribution by Private Appeal Funds	53
(5) Some Conclusions	55
IV EFFICIENCY AND EQUITY IN THE DISTRIBUTION OF NATURAL DISASTER RELIEF TO INDIVIDUALS — THEORETICAL ASPECTS	
(1) Efficiency in Taxation	60
(2) Equity in Taxation	61
(3) Efficiency and Equity in Natural Disaster Relief	69
V EFFICIENCY AND EQUITY IN THE DISTRIBUTION OF NATURAL DISASTER RELIEF TO INDIVIDUALS — THE QUEENSLAND 1974 FLOODS	73
(1) A Positive Analysis of the Criteria Adopted	74
(2) Evaluation of the Criteria Adopted	95
VI AN ALTERNATIVE SCHEME	
(1) Equitable Deductibles — Relating Damage Borne to Income	111
(2) The Problem of Moral Hazard	113
(3) Risk and Insurance	114
(4) Conclusion	118
APPENDIX A Some Considerations Relating to the Use of Net Worth in Means Tests	119
APPENDIX B Formulae for Determining Value of Damage Borne by Applicants other than Married Couples without Dependants	126
APPENDIX C Diagrammatic Presentation of Value of Damage Borne by the Applicant as a Function of Damage — Single Persons with Dependants (Cases 9-12)	134
BIBLIOGRAPHY	138

TABLES

	Page
II-1 Some Data on the Relative Importance of Australian Government Grants to the States for Natural Disasters, 1956-57 to 1976-77	3
III-1 Annual "Base" Expenditure by the State Governments on Agreed Measures for Natural Disaster Relief, 1970-71 to 1977-78	16
III-2 Expenditure by Queensland and Australian Governments on a Natural Disaster — A Hypothetical Example	18
III-3 Percentage Increase in States' Tax Rates Necessary Under Alternative Disaster Relief Policies	24
III-4 Percentage Increases in State Tax Rates Necessary to Raise Indexed and Horizontally Equalised "Base" Expenditures, 1970-71 to 1974-75	25
III-5 Percentage Increase in Local Government Tax Rates Necessary to Raise Local Government "Base" Expenditures Under Alternative Policies, Local Government Authorities (LGA's) in the Brisbane River Valley	27
III-6 Indexed Natural Disaster "Base" Expenditures for Nine Local Government Authorities in the Brisbane River Valley, 1970-71 to 1974-75	28
III-7 Percentage Increases in Local Government Taxes Necessary to Fund Hypothetical "Base" Expenditures for Nine LGAs in the Brisbane River Valley, 1970-71 to 1974-75	28
III-8 Per Capita "Base" Expenditures on Natural Disaster Relief by States, 1970-71 to 1975-76	30
III-9 Ratio of Per Capita "Base" Expenditures on Natural Disaster Relief in the Non-Standard States to the Simple Average of Per Capita "Base" Expenditures in the Standard States	31
III-10 Taxable Income Per Capita, by States, 1970-71 to 1974-75	32
III-11 Ratio of Per Capita Taxable Income in the Non-Standard States to Per Capita Taxable Income in the Standard States, 1970-71 to 1974-75	33
III-12 Indexed Per Capita "Base" Expenditures on Natural Disaster Relief in Standard and Non-Standard States Incorporating Fiscal Capacity Adjustments, 1970-71 to 1974-75	33
III-13 Indexed "Base" Expenditures on Natural Disaster Relief in Standard and Non-Standard States Incorporating Annual Fiscal Capacity Adjustments, 1970-71 to 1974-75	34
III-14 Indexed "Base" Expenditures on Natural Disaster Relief in Standard and Non-Standard States Incorporating Two Discrete Fiscal Capacity Adjustments, 1970-71 to 1976-77	35
IIII-1 Categories of Tangible Damage from a 5.45m. "Level Backwater" Flood in the Brisbane River, 1974	40
IIII-2 Insurance Claims Arising from Weather Conditions During January and February 1974 in the Brisbane Metropolitan Area	41
IIII-3 Total Damage, Absolute Damage and Proportion of Total Damage Met and Not Met by Insurance Claims, Brisbane River Flood, January 1974	43
IIII-4 Payments by the Queensland Government following the 1973-74 Floods, 1973-74 to 1975-76	45
IIII-5 Payments Incurred by the Queensland Government following the 1973-74 Floods, Constant Prices, 1973-74 to 1975-76	45
IIII-6 Some Conditions of Concessional Loans made following the 1974 Queensland Floods	46

III-7	Time Stream and 1973-74 Present Values of Grant Equivalents of Loans at Concessional Rates of Interest and Capital Gains of Loans	48
III-8	Grants and Grant Equivalents Incurred by the Queensland Government following the 1973-74 Floods, Constant Prices, 1973-74 to 1976-77	49
III-9	Absolute and Proportional Government Expenditures and Expenditure Equivalents following the 1973-74 Floods in Queensland, 1973-74	51
III-10	The Relative Importance of Certain Economic Variables for Selected Local Government Authorities	52
III-11	Grants and Grant Equivalents by the Queensland Government in the Brisbane River Catchment following the 1973-74 Floods, Constant Prices, 1973-74 to 1976-77	53
III-12	Summary of Criteria used by Respondent Private Appeal Funds for Distribution of Disaster Relief, Queensland, 1973-74	54
III-13	Absolute and Relative Assistance by Levels of Government following the 1973-74 Floods in Queensland	56
III-14	Absolute and Relative Damage Borne by Insurance, Government, Charities and Flooded Entities, Brisbane River Valley, 1973-74 Flood	57
IV-1	Combinations of Sacrifice Concepts and Income-Utility Functions	64
IV-2	Behaviour of Tax Payments as Income Increases	66
V-1	Damage to Residential Assets Borne by Insurance, Government, Charities and Flood Victims, Brisbane River Valley, 1973-74 Flood	73
V-2	Summary of Income and Wealth Means Tests — Personal Distress and Hardship Assistance	75
V-3	Combinations of Marital Status, Number of Dependants, Number of Employed Children Living at Home and Economic Position with Respect to the Income and Wealth Means Tests — Personal Distress and Hardship Assistance	76
V-4	Formulae for Determining Grants for Single Persons without Dependants (S) — Personal Distress and Hardship Assistance	77
V-5	Formulae for Determining Grants for Married Couples without Dependants (M) — Personal Distress and Hardship Assistance	78
V-6	Formulae for Determining Grants for Single Persons with Dependants (SDe) — Personal Distress and Hardship Assistance	79
V-7	Formulae for Determining Grants for Married Couples with Dependants (MDe) — Personal Distress and Hardship Assistance	80
V-8	Formulae for Determining Grants for Single Persons with Employed Children Living at Home (SZ) — Personal Distress and Hardship Assistance	81
V-9	Formulae for Determining Grants for Married Couples with Employed Children Living at Home (MZ) — Personal Distress and Hardship Assistance	82
V-10	Formulae for Determining Grants for Single Persons with Dependants and Employed Children Living at Home (SDeZ) — Personal Distress and Hardship Assistance	83
V-11	Formulae for Determining Grants for Married Couples with Dependants and Employed Children Living at Home (MDeZ) — Personal Distress and Hardship Assistance	84
V-12	Formulae for Determining Housing Repair and Rebuilding Grants	92

V-13	Formulae for Determining Value of Damage Borne by the Applicant — Married Couples without Dependants (M) — Personal Distress and Hardship Assistance	97
V-14	Formulae for Determining the Value of Damage Borne by the Applicant — Housing Repair and Rebuilding Assistance.....	109
A-1	Components of Total National Wealth, Britain, 1966	120
A-2	Some Liabilities of Financial Intermediaries in Australia	121
A-3	Some Data on Categories of Wealth in Australia, 1964-69	122
A-4	Proportions of Selected Liabilities to Total Liabilities of Major Australian Financial Intermediaries, 1964-74	124
B-1	Formulae for Determining Value of Damage Borne by the Applicant — Single Persons without Dependants (S) — Personal Distress and Hardship Assistance	127
B-2	Formulae for Determining Value of Damage Borne by the Applicant — Single Persons with Dependants (SDe) — Personal Distress and Hardship Assistance	128
B-3	Formulae for Determining Value of Damage Borne by the Applicant — Married Couples with Dependants (MDe) — Personal Distress and Hardship Assistance	129
B-4	Formulae for Determining Value of Damage Borne by the Applicant — Single Persons with Employed Children Living at Home (SZ) — Personal Distress and Hardship Assistance	130
B-5	Formulae for Determining Value of Damage Borne by the Applicant — Married Couples with Employed Children Living at Home (MZ) — Personal Distress and Hardship Assistance	131
B-6	Formulae for Determining Value of Damage Borne by the Applicant — Single Persons with Dependants and Employed Children Living at Home (SDeZ) — Personal Distress and Hardship Assistance	132
B-7	Formulae for Determining Value of Damage Borne by the Applicant — Married Couples with Dependants and Employed Children Living at Home (MDeZ) — Personal Distress and Hardship Assistance	133

FIGURES

	Page
II-1 Relationship between Australian Government and Queensland Government Assistance for Agreed Measures on Natural Disaster Relief — A Hypothetical Case.....	17
II-2 Relationship between Australian Government and State Government Assistance for Agreed Measures on Natural Disaster Relief	18
II-3 Relationship between Australian Government Assistance and Local Government Expenditure on the Restoration of Local Government Assets.....	21
IV-1 Income-Utility Function with Diminishing Marginal Utility of Income — Individuals with Equal Incomes	63
IV-2 Income-Utility Function with Diminishing Marginal Utility of Income — Individuals with Unequal Incomes.....	65
IV-3 Tax Payments as a Function of Income.....	67
IV-4 Application to Natural Disaster Relief of an Income-Utility Function with Diminishing Marginal Utility of Income	70
VI-1 Value of Damage Borne by Applicant as a Function of Damage — An Alternative Scheme	111
VI-2 Value of Damage Borne by Applicant as a Function of Income — An Alternative Scheme.....	112
VI-3 Equitable Deductibles Allowing for Ex Post Risk-Discrimination	115
VI-4 Co-insurance Rates on Uninsured Damage as a Function of Income	116
VI-5 Co-insurance, Deductible and Co-insurance/Deductible Provisions Unrelated to Risk or Income	117
VI-6 Co-insurance Rates Related to Risk but Unrelated to Income	117

CHARTS

	Page
I-1 Australian Government Payments to the States for Natural Disasters, 1962-63 to 1976-77	5
V-1 Value of Grant as a Function of Wealth — Case 3, Personal Distress and Hardship Assistance	86
V-2 Value of Grant as a Function of Wealth — Case 4, Personal Distress and Hardship Assistance	87
V-3 Value of Grant as a Function of Damage — Cases 1 and 2, Personal Distress and Hardship Assistance	89
V-4 Value of Grant as a Function of Damage — Cases 1 and 3, Personal Distress and Hardship Assistance	90
V-5 Value of Grant as a Function of Damage — Cases 1 and 4, Personal Distress and Hardship Assistance	90
V-6 Value of Grant as a Function of Net Realisable Assets — Housing Repair and Rebuilding Assistance	94
V-7 Value of Grant as a Function of Damage — Housing Repair and Rebuilding Assistance	94
V-8 Value of Damage Borne by Applicant as a Function of Damage — Cases 5 and 6, Personal Distress and Hardship Assistance	99
V-9 Value of Damage Borne by Applicant as a Function of Damage — Cases 5 and 6, Personal Distress and Hardship Assistance	101
V-10 Value of Damage Borne by Applicant as a Function of Damage — Cases 5 and 7, Personal Distress and Hardship Assistance	102
V-11 Value of Damage Borne by Applicant as a Function of Damage — Cases 5 and 8, Personal Distress and Hardship Assistance	105
V-12 Value of Damage Borne by Applicant as a Function of Damage — Cases 2 and 6, Personal Distress and Hardship Assistance	107
V-13 Value of Damage Borne by Applicant as a Function of Damage — Housing Repair and Rebuilding Assistance	108
C-1 Value of Damage Borne by the Applicant as a Function of Damage — Cases 9 and 10, Personal Distress and Hardship Assistance	135
C-2 Value of Damage Borne by the Applicant as a Function of Damage — Cases 9 and 11, Personal Distress and Hardship Assistance	136
C-3 Value of Damage Borne by the Applicant as a Function of Damage — Cases 9 and 12, Personal Distress and Hardship Assistance	137

I INTRODUCTION

Natural disasters are phenomena that have by no means been ignored by the social and the physical sciences.¹ However they are phenomena that have generally been neglected by economists², particularly in Australia. For example the authors of a recent book on bushfires paid virtually no attention to the economic significance of bushfires.³ This is a comment not on the authors of that detailed book, but on the discipline of economics in this country: there is no Australian literature on the economics of natural disasters.

The economic significance of a disaster (natural or man-made) lies in the partial or total destruction of natural or man-made resources or assets. Consequent to that damage or destruction to the stock of resources there is a further economic effect, in that the flow of current goods and services will be less than it would have been if the stock of resources had not been reduced by the disaster. Conceptually these two points are straightforward. However there are numerous difficulties that arise in making the two notions operational.⁴

A major reason why natural disaster research in Australia has been neglected by economists is that very few damage studies have been undertaken. To our knowledge there are only two reliable estimates of damage from natural disasters, the Tasmanian bushfires of 1967⁵ and flooding in the Brisbane River in 1974.⁶ A damage estimate for cyclone "Tracy" which struck Darwin on 25 December 1974 is also available but takes no account of damage to public or community assets.⁷ An incomplete time series of damage estimates for bushfires in Australia is available but the reliability of the data is acknowledged to be suspect.⁸

In Chapter III, we will be considering in some detail the available data on the Queensland floods in 1974, and more particularly data on flooding in the Brisbane River catchment at that time. The reason for the particular interest in the Brisbane River system relates to the availability of a quite detailed damage estimate for that river system.⁹ It is not possible to generalise in any meaningful way from the Brisbane River damage study to flood damage in the State of Queensland, or flood damage at the same time in other parts of Australia. This is the case because of the nature of the regional distribution of economic activity.

The lack of damage estimates for natural disasters in Australia imposes some limitations on the nature of economic analysis that can be undertaken. For example we can shed no light on questions such as the following:

- (a) Are natural disasters becoming more or less important through time?
- (b) Are natural disasters becoming more or less destructive of property or life?
- (c) Are natural disasters subject to regional variations?

Given the information available in the United States, Dacy and Kunreuther were able to provide answers to questions such as these.¹⁰ Analysing natural disaster damage data by using 10-year moving averages for the period 1925 to 1965, they have found that damage has been

¹ A comprehensive review of the disaster literature can be found in R. L. Wettenhall, *Bushfire Disaster: An Australian Community in Crisis*, Angus and Robertson, Sydney, 1975, Part One. See also G. F. White (ed.), *Natural Hazards: Local, National, Global*, Oxford University Press, New York, 1974.

² There are several notable exceptions, e.g. D. C. Dacy and H. Kunreuther, *The Economics of Natural Disasters*, The Free Press, New York, 1969; H. Kunreuther, *Recovery from Natural Disasters*, American Enterprise Institute for Public Policy Research, Washington D.C., 1973; and H. Kunreuther, "The Case for Comprehensive Disaster Insurance", *The Journal of Law and Economics*, Vol. XI, April 1968, and references cited therein.

³ R. H. Luke and A. G. McArthur, *Bushfires in Australia*, Australian Government Publishing Service (A.G.P.S.), Canberra, 1978.

⁴ For an account of some of these difficulties see Dacy and Kunreuther, *op. cit.*, Chapter 1; and Snowy Mountains Engineering Corporation, *Brisbane River Flood Investigations: Final Report*, Cities Commission, Canberra, 1975, *passim*.

⁵ A. G. McArthur, "The Tasmanian Bushfire of 7th February 1967 and Associated Fire Behaviour Characteristics", in *Second Conference Papers of Australian National Conference on Fire*, mimeo., 1968, pp. 25-48.

⁶ Snowy Mountains Engineering Corporation, *op. cit.*

⁷ Department of Repatriation and Compensation, *Darwin Damage Compensation: Report for Period 31 May to 30 June 1975*, Government Printer of Australia, Canberra, 1976, pp. 1-2.

⁸ T. Foster, *Bushfire: History, Prevention, Control*, Reed, Sydney, 1976, p. 236.

⁹ Snowy Mountains Engineering Corporation, *op. cit.*

¹⁰ *Op. cit.*, Chapter 1.

increasing through time at an annual compounded rate of 1.7 per cent.¹¹ This rate was higher than the rate of population growth and less than the growth in gross national product. However, the rate of increase in damage was about the same as the growth rate in per capita gross national product. Dacy and Kunreuther comment that "Relative to our ability to pay, natural disasters are no more of a problem today than they have been in the past even though their absolute costs have risen."¹² Their main conclusion, however, was that "in the long run disaster losses increase proportionately with the build up in damageable property".¹³ This is a surprising conclusion as, *ceteris paribus*, technological advances in building materials and architectural design, more stringent building regulations, damage prevention projects such as dams and better information on areas prone to natural hazards should all lead to a situation in which disaster losses through time should increase at a rate *lower than* that at which capital is accumulated.

Using five-year averages of the damage data from 1925 to 1965, Dacy and Kunreuther have found that the "life-property loss" relationship has been subject to a significant secular decline.¹⁴ In other words natural disasters in the United States have become relatively less destructive of life and more destructive of capital. This trend can be explained in part by more advanced warnings of impending natural disasters and the development of more efficient social and economic infrastructures that can quickly render assistance in a disaster area.¹⁵ On this matter we can report simply three facts: the lives lost per million dollars property loss (in 1973-74 prices) for the Tasmanian bushfires of February 1967, the flooding in the Brisbane River in January 1974, and cyclone damage in Darwin in December 1974 were 2.612, 0.084 and 0.410 respectively.¹⁶ It would be a hazardous exercise indeed to draw any conclusion from the available Australian data on this matter.

Because there are no time series estimates of natural disaster damage in Australia, we can say nothing of regional variations of risk to life or capital.

Although there is little information on damage from natural disasters, we have accurate and detailed data on Australian Government assistance to State Governments for all natural disasters since 1949-50. We present data on Recurrent and Capital Grants in column (1) and Total Payments (grants and loans) in column (2) of Table I-1¹⁷ for the twenty-year period to 1976-77. As one would expect, Australian Government payments to the States for natural disasters, being phenomena that occur randomly, exhibit no trend through time. These payments vary considerably from one year to another.

In considering the data of columns (1) and (2) of Table I-1, we should keep in mind that in 1970-71 a major change in Australian Government policy on natural disaster assistance took place. Prior to 1970-71 Australian Government assistance to State Governments for natural disaster relief took the form of a specific purpose, dollar-for-dollar matching grant on agreed measures of assistance. However this was not an invariant policy: a number of exceptions have occurred. From 1970-71 Australian Government assistance has been conditional on State Governments meeting expenditures from their own revenue sources up to a "base" expenditure requirement. The "base" varies from \$5,000,000 for the New South Wales Government to \$600,000 for the Tasmanian Government. The "base" expenditure requirements remained constant at these levels until they were doubled for each State in the 1978-79 Australian Government Budget.¹⁸

¹¹ *Ibid.*, p. 11.

¹² *Ibid.*, p. 11, Note (n.) 24.

¹³ *Ibid.*, p. 18.

¹⁴ *Ibid.*, Table I-1.

¹⁵ This point is well illustrated in Australia by the fact that only 66 people died during and after the time that cyclone "Tracy" devastated Darwin on 25 December 1974. For a detailed account of the measures that, in part, produced this extraordinary result see J. E. Haas, *The Consequences of Large Scale Evacuation Following Disaster: The Darwin Australia Cyclone Disaster of December 25, 1974*, Natural Hazard Research Working Paper 27, 1976.

¹⁶ Calculated from data in McArthur, *op. cit.*, p. 41, Wettenhall, *op. cit.*, p. 78, Snowy Mountains Engineering Corporation, *op. cit.*, Table 10, *Queensland Parliamentary Debates*, 1974, Vol. 264, p. 2628, Department of Repatriation and Compensation, *op. cit.*, p. 2 and Australia, House of Representatives, *Debates*, 1975, Vol. H. of R. 93, p. 1137.

¹⁷ The published data are disaggregated also by State and type of disaster. However such disaggregation is not relevant for our present purpose.

¹⁸ We discuss the various policies, and the implications of the present policy, in Chapter II Section (2). The discussion of the present policy is conducted in terms of the pre-1978-79 "base" expenditure amounts which were current at the time of writing.

Table I-1

SOME DATA ON THE RELATIVE IMPORTANCE OF AUSTRALIAN GOVERNMENT GRANTS TO THE STATES FOR NATURAL DISASTERS, 1956-57 to 1976-77

Year	Recurrent and Capital Grants for Natural Disasters ^a	Total Payments for Natural Disasters ^a	Recurrent and Capital Grants as a Proportion of Total Payments for Natural Disasters	Recurrent and Capital Grants for Natural Disasters as a Proportion of Specific Purpose Payments to the States ^b	Recurrent and Capital Grants for Natural Disasters as a Proportion of Total Payments to the States ^b	Recurrent and Capital Grants for Natural Disasters as a Proportion of Public Final Consumption and Gross Capital Expenditure ^c
	\$ (1)	\$ (2)	(3)	(4)	(5)	(6)
1956-57	1,434,000	1,434,000	1.00	0.00766	0.00251	0.00070
1957-58	1,177,000	1,177,000	1.00	0.00582	0.00187	0.00054
1958-59	509,000	509,000	1.00	0.00234	0.00076	0.00022
1959-60	327,000	327,000	1.00	0.00139	0.00044	0.00013
1960-61	645,000	645,000	1.00	0.00260	0.00080	0.00024
1961-62	641,000	641,000	1.00	0.00215	0.00069	0.00022
1962-63	130,000	130,000	1.00	0.00041	0.00013	0.00004
1963-64	120,000	120,000	1.00	0.00036	0.00012	0.00004
1964-65	100,000	100,000	1.00	0.00026	0.00009	0.00003
1965-66	9,746,000	21,740,000	0.45	0.02139	0.00777	0.00219
1966-67	13,353,000	21,073,000	0.63	0.02778	0.00983	0.00274
1967-68	17,502,000	27,954,000	0.63	0.03113	0.01152	0.00324
1968-69	11,697,000	22,131,000	0.53	0.02093	0.00073	0.00200
1969-70	9,114,000	13,972,000	0.65	0.01445	0.00501	0.00143
1970-71	14,567,000	19,423,000	0.75	0.02001	0.00605	0.00205
1971-72	6,573,000	6,912,000	0.95	0.00929	0.00267	0.00082
1972-73	2,000	2,000	1.00	—	—	—
1973-74	24,522,000	28,178,000	0.87	0.01562	0.00650	0.00229
1974-75	49,538,000	53,199,000	0.93	0.01670	0.00850	0.00334
1975-76	29,957,000	31,055,000	0.96	0.00721	0.00389	0.00167
1976-77	25,622,000	30,450,000	0.84	0.00630	0.00311	0.00126

Note: — less than half the final digit shown.

Sources: ^a Australian Treasury, *Payments to or for the States and Local Government Authorities 1975-76*, A.G.P.S., Canberra, 1975, Table 159; and Australian Treasury, *Payments to or for the States and Local Government Authorities 1977-78*, A.G.P.S., Canberra, 1977, Table 67.

^b Australian Treasury, *Payments to or for the States and Local Government Authorities 1974-75*, A.G.P.S., Canberra, 1974, Table 89; and Australian Treasury, *Payments to or for the States and Local Government Authorities 1977-78*, A.G.P.S., Canberra, 1977, Table 101.

^c Australian Bureau of Statistics, *Australian National Accounts: National Income and Expenditure 1974-75*, Australian Bureau of Statistics, Canberra, 1976, Table A, p. 108; and Australian Bureau of Statistics, *Australian National Accounts 1976-77: Preliminary Statement No. 1*, Australian Bureau of Statistics, Canberra, 1978, Table 1, p. 3.

In column (3) of Table I-1 we have calculated the ratio of "Recurrent and Capital Grants" to "Total Payments" for natural disasters for the years from 1956-57 to 1976-77. It is clear that until 1964-65 Australian Government assistance always took the form of grant assistance. In 1965-66 the Australian Government began to provide assistance by way of loans at concessional rates of interest. Such loans, being repayable, provide assistance by way of below prevailing rates of interest and the purchasing power gain that accrues to debtors through time if loans are not indexed for inflation.¹⁹ In our detailed study of the 1973-74 floods in Queensland we have determined that the grant equivalent of such loans is considerably smaller than is indicated by the value of the loans themselves. Thus "Recurrent and Capital Grants" give a better indication, although a minimum indication, of Australian Government assistance to the States for natural disaster relief than do "Total Payments".

¹⁹ We consider these matters in some detail in Chapter III Section (3).

In columns (4), (5) and (6) of Table I-1 we present some ratios that indicate the relative importance of Australian Government grants for natural disasters compared to total specific purpose payments to the States, total payments to the States and public final consumption and gross capital expenditure respectively. It is clear from column (6) that Australian Government expenditure on natural disaster relief is a very small proportion of government expenditure. The proportion varies from virtually zero in 1972-73 to 0.3 per cent in 1974-75. This same variability exists in the other measures we have calculated. In column (5) we have calculated grants for natural disasters as a proportion of total Australian Government payments to the States. This proportion varies from virtually zero in 1972-73 to 1.15 per cent in 1967-68. The proportion of natural disaster grants to total specific purpose payments varies from virtually zero to 3.1 per cent in 1967-68. Not only are Australian Government grants for natural disasters a small aspect of government expenditure in general, but they are also a small aspect of general intergovernmental transfers as well as specific purpose transfers.

In Chart I-1 we indicate time series payments (in constant 1973-74 prices) by the Australian Government for particular types of natural disasters. We see that extreme variability exists not only in total payments but also in payments for particular types of disasters. It is clear from Chart I-1 that the natural disasters which are most important in terms of Australian Government specific purpose payments to the States have been "drought" and "flood and storm".

Having said what we cannot do in terms of an economic analysis of natural disasters in Australia, we now describe the subject matter of this monograph. In Chapter II we consider some theoretical questions of the role of government in natural disasters. More specifically we address the question of the appropriate level of government to bear the costs of natural disaster damage. Employing Musgrave's "branch" conception of the public sector we conclude that the central government should fund relief to individuals following a natural disaster, because such payments can be regarded as a function of the distribution branch. On the other hand we conclude that there is an allocative dimension to damage to government assets and that individual sub-national governments should be responsible for damage to their own assets. We then analyse the existing government policy in Australia and compare that policy with previous policies on the matter of natural disasters. We discuss the existing policy in terms of the concepts of vertical and horizontal imbalance, as these phenomena characterise the Australian federal system of government.

In Chapter III we consider in detail the damage study of flooding in the Brisbane River valley in January 1974. From previously published and our own survey data, we determine as accurately as possible who bore the costs of damage (societal mechanisms of insurance, government and private philanthropy and the individual flood victims themselves), by the asset categories of government, private production and private consumption.

In the remainder of the monograph we concentrate attention on one aspect of the 1974 flood — the extent to which the societal mechanism of government bore the costs of damage to private sector assets. In the context of Australian Government assistance to flood victims in Queensland in 1973-74, this means that we focus our attention on the "Personal Distress and Hardship Scheme" and the assistance made available under the "Housing Repair and Rebuilding Scheme". Government assistance to flood victims under these schemes was not "open-ended" — means tests were devised and employed to determine individual flood victims' entitlements to government assistance under the two schemes.

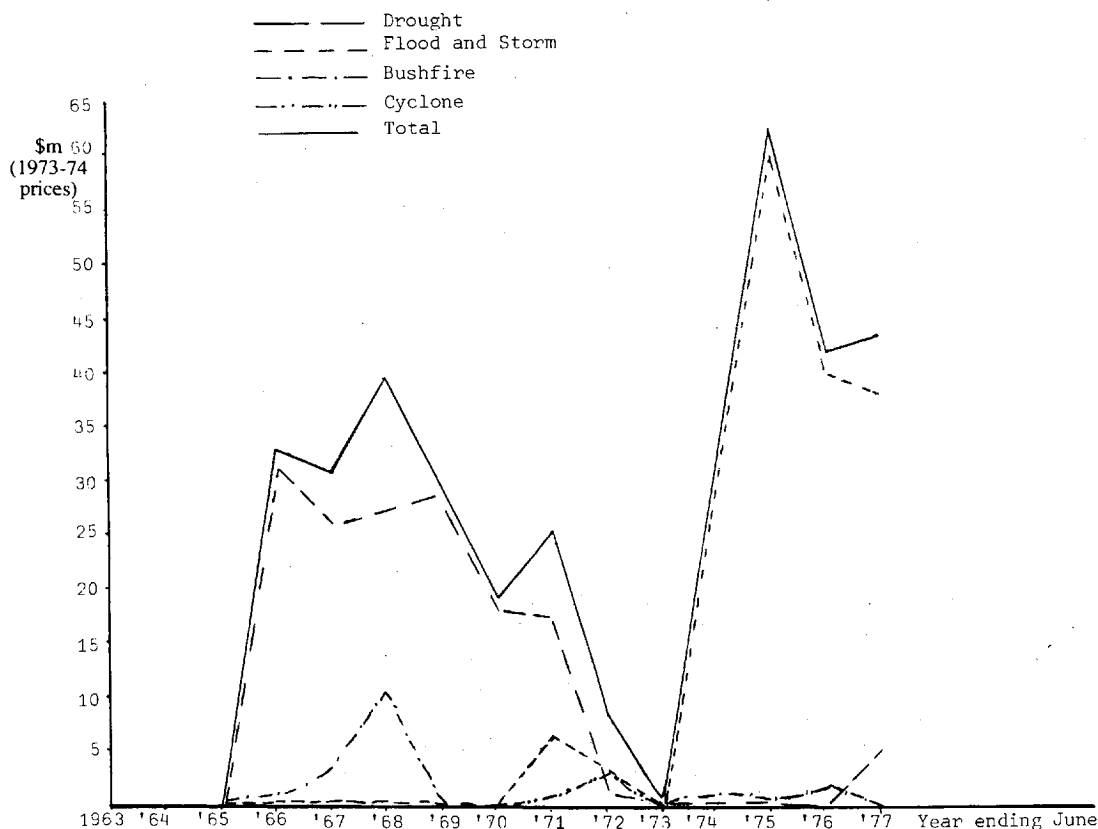
Chapters IV and V are concerned with evaluating these two relief schemes while Chapter VI discusses a possible alternative. In Chapter IV, we consider the public finance literature on taxation theory. In particular, we discuss the principles of efficiency and equity in taxation in the context of natural disaster relief with a view to establishing a benchmark for evaluation of the two relief schemes. The efficiency considerations indicate that, in order to minimise the potential excess burden, a relatively "broad" definition of income should be used. The equity considerations lead to the following conclusions. First, disaster victims in equal economic positions should receive government relief of amounts which result in their bearing equal values of damage themselves. Secondly, the absolute value of damage to be borne by a flood victim should increase as his income increases.

We begin Chapter V with a detailed analysis of the means tests that were actually employed in implementing the Personal Distress and Hardship and Housing Repair and Rebuilding Schemes. Although the exposition is predominantly algebraic (for ease of exposition), diagrammatic presentations of the major issues are also given. We then evaluate the means tests by reference to the criteria discussed in the previous chapter. Under the circumstances prevailing in 1973-74, we conclude that the efficiency (excess burden) considerations were not significant. However, this was not the case with the equity considerations. We have found that government assistance to Queensland flood victims in 1973-74 was distributed in an inequitable manner under both schemes. By this we mean not only that flood victims in equal economic positions were treated unequally but also that flood victims in unequal economic positions were treated equally. That is to say that the means tests applicable to both relief schemes violated the notions of horizontal and vertical equity as these notions apply in the context of natural disaster relief to individuals. In view of these conclusions, Chapter VI outlines a possible alternative scheme for distributing natural disaster relief to individuals which fulfils the principles of equity and efficiency in taxation.

Chart I-1

AUSTRALIAN GOVERNMENT PAYMENTS TO THE STATES FOR NATURAL DISASTERS, 1962-63 to 1976-77

\$m (1973-74 prices)



Note: Payments to Western Australia for earthquake damage in 1968-69 to 1970-71 are not shown here.

Sources: Australian Treasury, *Payments to or for the States and Local Government Authorities 1974-75*, A.G.P.S., Canberra, 1974, Table 137; Australian Treasury, *Payments to or for the States and Local Government Authorities 1977-78*, A.G.P.S., Canberra, 1977, Table 118; and Australian Bureau of Statistics, *Consumer Price Index - June Quarter 1977*, Australian Bureau of Statistics, Canberra, 1977.

II NATURAL DISASTER RELIEF IN A FEDERAL SYSTEM

(1) Theoretical Aspects

To which level of government — Federal, State or local — should the responsibility for natural disaster relief expenditure be assigned? This section is concerned with theoretical analysis which will help to answer this question.

Consider first the economic justification for government intervention in the economy. On the basis of Musgrave's conceptual framework,¹ there are three reasons why the government should intervene in the operation of the market mechanism.

(a) *Allocation*. Even in a perfectly competitive economy, social welfare may not be maximised because of the problem of market failure. Externalities and public goods are familiar causes of this problem. Government intervention may then be required to secure an optimal allocation of resources.

(b) *Stabilisation*. The unhindered operation of the price mechanism will not necessarily lead the economy to a sustained level of full employment without inflation. The government will then need to correct this problem by the use of the macroeconomic instruments at its disposal.

(c) *Distribution*. The distribution of income which results from the unhindered operation of a market system may be unacceptable on equity grounds. Government intervention designed to achieve a "just" distribution of income will then be necessary.

These three reasons for government intervention then define the three economic functions of government. The three functions should not be thought of as being completely independent. On the contrary, government taxation and expenditure policy to fulfil the allocative function can be expected to impinge upon the stabilisation and distribution objectives. Nevertheless, this classification of functions is very useful in analysing the role of the public sector in an economy, particularly in a federal system.

Given the foregoing economic objectives of government, the next step is to consider whether such objectives are better achieved in a system of government which is completely centralised, completely decentralised or some combination of the two and, if partial or complete decentralisation is desirable, which functions should be assigned to each level of government.

The case for a completely centralised or unitary system of government is based upon considerations relating to the achievement of the stabilisation and distribution objectives.² The proper conduct of stabilisation policy requires central government control over the money supply. If this power were vested in regional governments, they would have an incentive to expand the money supply on the assumption that goods could easily be imported from neighbouring communities to satisfy the increased demand. This would tend to be very inflationary. The tendency for regional economies to be open economies also militates against the use of fiscal policy at the regional level.

A major problem with distributional policies at the regional level is migration. Even though individuals may be in favour of redistribution programs to eliminate poverty, those paying taxes will still attempt to "free-ride" by relocating in the lower-tax regions while those receiving income subsidies will relocate in the higher-subsidy regions. In Musgrave's words: "Inter-state differentials in redistribution policies, if substantial, will be a distorting factor in location, and by inducing population movement (with the rich leaving and the poor entering the more egalitarian states) will prove self-defeating."³ Differences in regional policies on redistribution may also offend equity notions if they result in widely disparate treatment of individuals with equal incomes in different regions. Thus, in terms of the stabilisation and distribution functions, a strong case can be made for a central or unitary system of government.⁴

¹ R. A. Musgrave, *The Theory of Public Finance*, McGraw-Hill, New York, 1959.

² See W. E. Oates, *Fiscal Federalism*, Harcourt Brace Jovanovich, New York, 1972, Chapter 1.

³ R. A. Musgrave, "Theories of Fiscal Federalism", *Public Finance*, Vol. 24, No. 4, 1969, p. 530.

⁴ For a contrary view on the distribution function of government see M. V. Pauly, "Income Redistribution as a Local Public Good", *Journal of Public Economics*, Vol. 2, January 1973.

The case for a partially or completely decentralised system of government arises from a consideration of the allocation function. One of the reasons for government intervention to correct the allocation of resources is the existence of public goods, defined in the Samuelsonian sense whereby "each individual's consumption of such a good leads to no subtraction from any other individual's consumption of that good".⁵ Optimal provision of such a good would require government intervention with differential tax pricing according to the marginal valuation of each consumer, i.e. benefit pricing, with the sum of these marginal valuations equalling the marginal cost of providing the good.

The benefits arising from the provision of public goods may accrue to all individuals within a nation, e.g. defence, or they may be spatially limited to some particular region, e.g. police and fire protection. Oates's Decentralization Theorem states:

"For a public good — the consumption of which is defined over geographical subsets of the total population, and for which the costs of providing each level of output of the good in each jurisdiction are the same for the central or the respective local government — it will always be more efficient (or at least as efficient) for local governments to provide the Pareto-efficient levels of output for their respective jurisdictions than for the central government to provide any specified and uniform level of output across all jurisdictions."⁶

The characteristic of sub-national public goods, i.e. public goods with a spatial limitation on the consumption of benefits, is that their level of provision can be varied across jurisdictions, different amounts being provided to different subsets of the population. There is thus a case on economic efficiency grounds for allowing each sub-national government to determine the output levels of those public goods which have benefits extending only to those people within its jurisdiction.⁷ The welfare gains from such a system of provision are enhanced if consumer mobility is taken into consideration, for each consumer may then locate in a jurisdiction which provides "a fiscal package well suited to his preferences".⁸

To summarise, the stabilisation and distribution functions of the government sector should be discharged by the central government. The level of government which discharges the allocative function will depend upon the spatial spread of benefits of any particular public good. In general, "national" public goods should be provided by the central government while "sub-national" public goods should be provided by lower-level governments.

Two problems which commonly arise in a federal system of government have been termed "horizontal imbalance" and "vertical imbalance". Horizontal imbalance refers to a situation where economic inequalities between lower-level governments are such that "if they were all to have equal standards of public expenditure over an equal range of public services and had to finance that expenditure from their own revenue sources, some of them would have to set their taxes and other charges at a higher level of severity than others — a situation which it is convenient to describe as inequalities in fiscal capacity".⁹ Thus, taking income as the tax base, a relatively low-income jurisdiction would have to impose higher income tax rates than a relatively high-income jurisdiction in order to provide an equal standard of public expenditure. This would lead to differential treatment of individuals with equal incomes living in different jurisdictions, a situation which offends against the principle of horizontal equity in taxation, or the equal treatment of persons with equal incomes.¹⁰

⁵ P. A. Samuelson, "The Pure Theory of Public Expenditure", *Review of Economics and Statistics*, Vol. 36, 1954, reprinted in R. W. Houghton (ed.), *Public Finance*, Penguin, Harmondsworth, 1970, p. 179.

⁶ Oates, *op. cit.*, p. 35 (emphasis in original).

⁷ In reality, this perfect correspondence whereby "the jurisdiction that determines the level of provision of each public good includes precisely the set of individuals who consume the good" (*ibid.*, p. 34) is unlikely to exist, with the result that interjurisdictional externalities will become a problem. See *ibid.*, Chapter 3 for a discussion of this problem.

⁸ *Ibid.*, p. 12. See C. Tiebout, "A Pure Theory of Local Expenditures", *Journal of Political Economy*, Vol. 64, October 1956, pp. 416-24 for a discussion of consumer mobility in this context.

⁹ W. R. Lane, "Australian Federalism: Equity and Efficiency", Department of Economics, University of Queensland, *mimeo.*, 1968, p. 2. This problem has been discussed in detail in a paper by J. M. Buchanan, "Federalism and Fiscal Equity", *American Economic Review*, Vol. 40, No. 4, September 1950, pp. 583-99.

¹⁰ This assumes that persons with equal incomes are also equal in other relevant respects. The principle of horizontal equity is discussed in more detail in Chapter IV.

The existence of horizontal imbalance provides a case for geographically discriminatory tax rates, but since this is unlikely to be feasible (e.g. for constitutional or practical reasons), an inter-jurisdictional transfer would be necessary to correct the problem. If this transfer is achieved through unconditional intergovernmental grants, either between lower-level governments or from a higher-level government, achievement of horizontal equity is not guaranteed because "it leaves each of the governments receiving the equalizing grants free to pursue its own policies. If these differed drastically equals located in different jurisdictions would still receive very unequal fiscal treatment".¹¹ Transfers by means of unconditional grants are based on the concept of fiscal capacity equalisation whereby the relatively low-income jurisdiction is given complete freedom in the uses to which the grant may be put. The grant simply ensures that fiscal capacity is equalised and does not interfere with the recipient government's taxation or expenditure priorities or ensure that horizontal equity is achieved. If, however, a concept of fiscal performance equalisation were adopted, the central government would be concerned not only with equalisation of the recipient government's fiscal capacity but also with the equalisation of certain standards of fiscal performance in taxation or expenditure policies. In this case unconditional matching grants or conditional (matching or unmatching) grants may be used to ensure a predetermined level of budgetary performance. In this way it may be possible for interjurisdictional transfers by way of intergovernmental grants to approximate more closely the achievement of horizontal equity.¹²

Vertical imbalance refers generally to a situation where there is "a non-correspondence between revenue resources and expenditure commitments for each level of government".¹³ For example, the lower-level governments may have insufficient access to tax bases to enable them to raise sufficient revenue to carry out their expenditure responsibilities.¹⁴ They would then have to rely on grants from the central government to obtain the extra revenue required. If such grants were designed solely to correct for vertical imbalance, they would be general and without matching conditions. The problem with vertical imbalance is that the fiscal autonomy of the lower-level governments will be undermined to the extent that they cannot increase their levels of expenditure without having to request financial assistance from the central government.

We now turn directly to the question posed at the beginning of this section — to what level of government should the responsibility for natural disaster relief expenditures be assigned? In the context of the foregoing theoretical discussion, the answer will depend upon the function the government is attempting to fulfil in undertaking expenditure for natural disaster relief purposes. For example, if the expenditure is primarily for redistributive purposes, the responsibility should rest with the central government.

To analyse this question further, we may consider the damage suffered as a result of a natural disaster affecting assets owned by either the public or the private sector. Within the public sector, the assets may be owned by either the national or sub-national governments. Within the private sector the assets may be owned by either firms or households.

Consider first damage to public sector assets. If a government has substantial asset holdings, it will usually self-insure, meaning that it will itself usually carry the risks of financial loss as a result of damage to its assets. In the event of a natural disaster, the government will then finance the repairs to its assets from its own revenue sources. In the case of a sub-national government, the existence of vertical imbalance may prevent it from doing so. The sub-national government may have insufficient access to revenue sources to enable it to repair the damage. In this case, it may either turn to the higher-level government to obtain loans or grants or borrow from the public.

¹¹ W. R. Lane, "Financial Relationships and Section 96", *Public Administration*, Vol. 34, No. 1, March 1975, p. 59. Buchanan argues that these intergovernmental transfers would also be conducive to the attainment of economic efficiency. This argument proved to be rather controversial but we will not pursue the debate here. For references to the literature, see Oates, *op. cit.*, p. 83, n. 21.

¹² For a detailed discussion of the two concepts of fiscal equalisation, see R. L. Mathews, "Mechanisms for Fiscal Equalisation in an Integrated European Community", in *Report of the Study Group on the Role of Public Finance in European Integration*, Volume II, Brussels, April 1977, Chapter 13.

¹³ J. S. H. Hunter, "Vertical Intergovernmental Financial Imbalance: A Framework for Evaluation", *Finanzarchiv*, Vol. 32, No. 3, 1974, p. 481.

¹⁴ For a more sophisticated definition of the concept of vertical imbalance see W. R. Lane, "Direct Taxes in Relation to the Division of Fiscal Powers", in R. L. Mathews (ed.), *Intergovernmental Relations in Australia*, Angus and Robertson, Sydney, 1974, esp. pp. 132-5.

Suppose we have a national government N and two sub-national governments SN1 and SN2. Assume also that N collects all taxation revenue and that SN1 and SN2 obtain all their funds solely by way of grants from N. Instead of SN1 and SN2 self-insuring for damage to their assets, N can now be regarded as the insurer, although no explicit premium is paid by SN1 and SN2 to N. This situation has arisen because of the vertical imbalance between the sub-national and national governments.

Let us for the moment abstract from the problem of horizontal imbalance and assume that the SN1 and SN2 jurisdictions have the same fiscal capacity. Assume also that the two jurisdictions have the same value of public sector assets per capita and that the SN1 jurisdiction has the characteristic that, in general, it has a much higher probability of suffering natural disaster damage than SN2. There is thus a much higher risk of damage to public sector assets in the SN1 jurisdiction than in the SN2 jurisdiction. If SN1 and SN2 each had had sole access to the tax base within its jurisdiction, then, if per capita levels of public expenditure on all other services are assumed to be equal, SN1 would have needed to levy higher tax rates than SN2. This is because the expected per capita value of damage to assets in the SN1 jurisdiction is higher than that in the SN2 jurisdiction.¹⁵ However, N collects all tax revenue. If it levies uniform tax rates in both jurisdictions and fully reimburses both jurisdictions for damage to public sector assets, the taxpayers in the SN2 jurisdiction (the lower-risk jurisdiction) will be cross-subsidising taxpayers in the SN1 jurisdiction (the higher-risk jurisdiction). This is an inefficient outcome for two reasons. First, the economic incentive for taxpayers in the SN1 jurisdiction to relocate in the SN2 jurisdiction (and hence reduce the quantity of public sector assets demanded in the SN1 jurisdiction) is removed. Secondly, if the risk of loss from a natural disaster varies geographically within the SN1 jurisdiction, the incentive for SN1 to locate its assets in relatively low-risk areas within its jurisdiction is removed. By contrast, if the costs of SN1's locational decisions for its assets were passed on to its taxpayers, it would have an incentive to locate its assets in relatively low-risk areas. Both of these phenomena are manifestations of the problem of "moral hazard" in insurance.¹⁶

If N cannot levy geographically discriminatory tax rates in SN1 and SN2, there is no scope for risk-discrimination in taxation. However, N could risk-discriminate in terms of expenditures on disaster relief for public sector assets in SN1 and SN2. It could do this by the use of a co-insurance provision or a deductible provision or some combination of the two. For example, it may require SN1 to meet a specified proportion (e.g. 10 per cent) of all expenditure on restoration of its assets after the disaster (a co-insurance provision). Alternatively, it may require SN1 to meet the first \$x of expenditure on the restoration of its assets (a deductible provision). It may also use some combination of these two provisions.¹⁷ The provision could be tailored so as to give SN1 an incentive to locate its assets in the lower-risk areas within its jurisdiction.

We have so far ignored the possibility that the risk of damage to public sector assets in the SN2 jurisdiction may also vary within the jurisdiction. In this case, co-insurance or deductible provisions could also be applied to SN2 in such a way as to induce it to locate its assets in relatively low-risk areas. However, as long as the risk of damage is generally much higher in the SN1 jurisdiction than in the SN2 jurisdiction, the former will have a higher co-insurance rate or per capita deductible than the latter.

¹⁵ If we relax the assumption that the two jurisdictions have the same per capita value of public sector assets, this conclusion may not hold. In particular, the higher probability of a natural disaster in SN1 may be more than offset by a lower per capita value of public sector assets, so that the expected per capita value of damage to such assets is actually lower than in SN2. In this case, the higher probability of a natural disaster in SN1 would be having an effect on the expenditure side of the budget (namely, reduced expenditure on public sector assets) rather than on tax rates.

¹⁶ The problem of moral hazard arises when the insured by his behaviour can influence the expected value of the loss. For a discussion of this problem see K. J. Arrow, "Uncertainty and the Welfare Economics of Medical Care", *American Economic Review*, Vol. 53, No. 5, December 1963, reprinted in M. H. Cooper and A. J. Culyer (eds), *Health Economics*, Penguin, Harmondsworth, 1973, pp. 34-5. See also M. V. Pauly, "The Economics of Moral Hazard: Comment", *American Economic Review*, Vol. 58, No. 3, June 1968, pp. 531-7; K. J. Arrow, "The Economics of Moral Hazard: Further Comment", *American Economic Review*, Vol. 58, No. 3, June 1968, pp. 537-9.

¹⁷ In our abstract model, since SN1 has no access to the tax base, it would have to meet the required expenditures by borrowing either from the public or from the national government N. In either case, the citizens in the SN1 jurisdiction would be fiscally worse off than those in the SN2 jurisdiction because SN1 would have to pay interest on and repay the debt and hence reduce public expenditure in other areas. In reality, the sub-national government would have access to some tax bases and could finance the required expenditure from this source if it so desired. The citizens of the SN1 jurisdiction would then be worse off as a result of the relatively higher tax rates.

It is perhaps worth emphasising that the above hypothetical situation arises because of the problem of vertical imbalance between the sub-national and national governments. If the sub-national governments have sufficient access to tax bases to enable them to self-insure, the insurance of their assets may be "internalised" within each jurisdiction. The national government will not then need to act as an insurer of the assets owned by lower-level governments.

It should also be mentioned that there is nothing in the foregoing analysis to suggest that grant relief from the national government should be in the form of specific purpose payments. Unless there is an objective other than that of merely carrying insurance for lower-level governments, the grants should be general purpose grants and equal to the value of damage to public sector assets, allowing for any co-insurance or deductible provisions.

The foregoing discussion assumed that the SN1 and SN2 jurisdictions had equal fiscal capacities but had differing risks of damage to public sector assets from a natural disaster. We will now assume that the two jurisdictions have equal risks of damage to public sector assets but have differing fiscal capacities. If we assume that income is the tax base, one of the jurisdictions will then have a relatively lower income level than the other. If an equal range and standard of public services is to be provided in each jurisdiction, the government of the lower-income jurisdiction will need to levy higher tax rates to finance its expenditures. Horizontal imbalance is then a problem.

Suppose that the SN1 jurisdiction is the relatively low-income jurisdiction. Since the national government N has sole access to the tax base, the problem of vertical imbalance still exists. N continues to act as insurer for natural disaster damage to the assets owned by SN1 and SN2. Assume that SN1 and SN2 have the same value of public sector assets per capita. Since the probability of disaster damage in each jurisdiction is the same, the expected per capita value of damage to public sector assets will be the same in each jurisdiction. If SN1 and SN2 each had sole access to the tax base within its jurisdiction, SN1 would need to impose higher tax rates on its constituents than SN2 to finance the expected value of damage to its assets, because of its lower fiscal capacity.¹⁸ However, the national government N collects all tax revenue. If it levies uniform tax rates within the nation and fully reimburses SN1 and SN2 for natural disaster damage to their assets, this will cause a redistribution of income from the higher-income to the lower-income jurisdiction, tending to correct the horizontal imbalance.

If the national government N has decided to use co-insurance or deductible provisions to encourage location of public sector assets in relatively low-risk areas within the jurisdiction, it is pertinent to ask what effects these provisions will have on horizontal imbalance. Consider first the co-insurance provisions. Since the SN1 and SN2 jurisdictions have generally the same probability of suffering natural disaster damage, then a co-insurance rate structure based purely on risk factors will be the same for SN1 and SN2. The co-insurance provision itself will be neutral with respect to horizontal imbalance because the expected per capita value of damage to public sector assets to be borne by SN1 and SN2 will be the same. "Neutral" in this context means that the co-insurance provision will neither correct nor worsen the horizontal imbalance between SN1 and SN2 by comparison with the horizontal imbalance that would have existed if SN1 and SN2 had to self-insure fully for damage to their assets.¹⁹ SN1 would then have to impose higher tax rates on its constituents than SN2 to finance its contribution.²⁰ The co-insurance provision could be tailored to correct for horizontal imbalance by applying a lower co-insurance rate to lower-income jurisdictions.

Insofar as deductible provisions are concerned, an equal per capita deductible applied to each jurisdiction will be neutral with respect to horizontal imbalance for the same reason as in the

¹⁸ If we relax the assumption that the two jurisdictions have the same per capita value of public sector assets, this conclusion may not hold. If SN1 had a smaller per capita value of public sector assets than SN2, it is possible that the difference could be such that SN1 would need to levy the same increase in tax rates as SN2 to finance the expected value of damage to its assets. In this case, the lower fiscal capacity of SN1 would be exerting its effect on the expenditure side of the budget (caused by a lower per capita value of public sector assets) rather than on tax rates.

¹⁹ The introduction of the co-insurance provision into a system in which horizontal imbalance had already been completely corrected would, of course, re-introduce some horizontal imbalance between the jurisdictions. For the use of the uncorrected horizontal imbalance position as a benchmark for the definition of neutrality or non-neutrality of Australian Government grants, see R. L. Mathews and W. R. C. Jay, *Federal Finance: Intergovernmental Financial Relations in Australia Since Federation*, Nelson, Melbourne, 1972, pp. 5-6.

²⁰ The comment in n. 17 is applicable in this context.

case of equal co-insurance rate structures applied to each jurisdiction. Again, the deductible provision could be tailored to correct for horizontal imbalance if a lower per capita deductible were applied to the lower-income jurisdiction.

It should again be noted that there is nothing in this analysis which suggests that the grant relief to the sub-national governments should take the form of specific purpose payments. General revenue grants are required, with the sub-national governments determining their own taxation and expenditure priorities.²¹

The conclusions of the foregoing analysis may now be summarised. In the absence of vertical imbalance, responsibility for natural disaster relief expenditures on public sector asset damage should rest with the level of government which owns the assets. When vertical imbalance is present, the higher-level government becomes an insurer for damage to the assets of lower-level governments. If the grants to lower-level governments are to be based on efficiency principles then, in the absence of geographically discriminatory tax rates, the national government should risk-discriminate in the distribution of grants by the use of co-insurance or deductible provisions. If horizontal imbalance is present then, if uniform tax rates are levied by the national government and sub-national governments are fully reimbursed for damage to their assets, the grants will have a tendency to correct the horizontal imbalance. This tendency will be reinforced if co-insurance or deductible provisions are in operation which apply lower co-insurance rates or per capita deductibles to those jurisdictions with relatively low fiscal capacities.

It is clear that the national government may be faced with an efficiency/equity dilemma. If the relatively high-risk jurisdictions also happen to have relatively low fiscal capacities, co-insurance or deductible provisions based solely on efficiency principles will do nothing to correct the horizontal imbalance. It is also possible, however, that the jurisdictions with relatively low fiscal capacities will also be relatively low-risk jurisdictions. In this case, both efficiency and equity principles require that the relatively low-risk jurisdiction be subject to a lower co-insurance rate or per capita deductible.

The second aspect of the question concerning the assignment of responsibility for natural disaster relief expenditures relates to damage to private sector assets. At first sight, it may seem that there is no economic justification for government provision of such relief, for insurance cover is available in the private sector. However, cover against specific disasters may not be available. For example, flood insurance poses problems because of the adverse selection of risks arising from the fact that relatively high-risk areas are well known. Also, catastrophic damage may arise from a single event.²² This could be considered to be an example of "market failure", in which case government intervention may be necessary on allocative grounds.²³

If government intervention is undertaken purely for allocative reasons, there is no *a priori* reason why the insurance should not be provided by the sub-national governments through their own government insurance offices. However, if there are economies of scale in the provision of insurance as seem to exist, for example, in the provision of health insurance,²⁴ there may be a case for the national government operating a national insurance office.

A government insurance office operating as a public enterprise would have scope for risk-discrimination in setting both the premiums and the benefits. Whether the premiums were compul-

²¹ If, however, there are great differences between the policies of the sub-national governments, translation of horizontal equalisation into horizontal equity between individuals may require some conditions to be attached to the grants. See W. R. Lane, "Financial Relationships and Section 96", *op. cit.*, p. 59.

²² For a discussion of problems arising with flood insurance, see J. L. Irish, "Flood Insurance", in *Proceedings of Symposium on Flood Plain Management*, The Institution of Engineers, Australia, Queensland Division, June 1976, pp. 1-12.

²³ An alternative argument to explain the unavailability of certain types of disaster insurance is based on what might be called "institutional failure". Current insurance practice is based upon the reserves principle rather than on an alternative theory of insurance — the mutuality principle. Insurance based upon the reserves principle cannot provide cover against losses from particular types of natural disasters because the requisite conditions for the success of such insurance are not fulfilled. In the words of John Marshall: "Many limitations of existing insurance are traceable to restrictions imposed by the reserves conception; among these limitations is lack of coverage against catastrophe." See J. M. Marshall, "Insurance Theory: Reserves versus Mutuality", *Economic Inquiry*, Vol. 12, No. 4, December 1974, pp. 476-92. Thus, the problem might be corrected without government intervention if insurance cover against natural disaster damage were based on the mutuality principle.

²⁴ See K. J. Arrow, "Uncertainty and the Welfare Economics of Medical Care", *op. cit.*, pp. 36-7.

sory or voluntary, they would be determined on the basis of risk. Similarly co-insurance or deductible provisions applying to benefits could also incorporate some degree of risk-discrimination. If the insurance office operated as a government department financing its operations from tax revenue, co-insurance or deductible provisions could again be applied to the benefits in such a way as to achieve some degree of risk-discrimination.

It is possible that, in the case of relief expenditures on damage to household assets, a distributional objective may also be pursued. In this situation, responsibility for the relief expenditure should rest with the central government, which is in a position to ensure that the distributional objective is achieved. If the national government insurance office operates as a separate entity, an equity objective would suggest that the premiums and benefits be determined not on the basis of an individual's risk but rather on the basis of his economic position. If the insurance office is operating as a department of the national government financing its operations from tax revenue, it can pursue the equity objective only by relating the benefit (or relief expenditure) for an individual to his income (as the determination of an income-related premium is not possible). In these cases, the relief expenditures become negative taxes and their distribution can be analysed within the framework of efficiency and equity in taxation. The criteria for distribution should then reflect the principles of efficiency (or neutrality) and equity in taxation. This matter is taken up in Chapter IV, where we present the theory of efficiency and equity in taxation and relate that theory to natural disaster relief for individuals.

The pursuit of a distributional objective by the national government does not necessarily imply that the sub-national governments will be by-passed in the expenditure process. On the contrary, the system may operate by means of specific purpose payments to the sub-national governments, detailed criteria for distribution being attached as conditions of the grants. In Chapter V, we will be concerned with analysing and evaluating such a set of criteria attached to a specific purpose payment.

We may now summarise our analysis of the assignment of the responsibility for private sector natural disaster relief expenditures. If government intervention is undertaken solely for allocative reasons, insurance offices may be operated by any level of government, although administrative economies of scale may permit large offices to achieve cost savings. Risk-discrimination may be pursued through co-insurance or deductible provisions either in the determination of premiums or in the distribution of benefits. If a distributional objective is to be pursued in relief expenditures for households, the responsibility for such expenditure should rest with the national government. Criteria for the distribution of such relief, based on the principles of efficiency and equity in taxation, may then be consistently employed, with the national government dealing directly with the relevant individuals or applying the criteria through conditions attached to a specific purpose payment to the sub-national governments.

(2) The Development of Policy on Natural Disasters in Australia

If we were to ask the question "what level of government in Australia is responsible for assistance following a natural disaster?", the answer that would come to mind first is the State Governments.²⁵ In the Commonwealth Constitution, power in the matter of (or administrative responsibility for) natural disasters was not, and has not subsequently been, referred to the Australian Government. Thus policy on natural disasters can be regarded as a residual (or unspecified) power that has, since federation in 1901, remained a function of the State Governments.

However, Australian Government funds have been allocated to natural disasters since February 1939, when the Australian Government gave \$2,000 (£1,000) for bushfire relief in Tasmania.²⁶ Australian Government policy was *ad hoc* for some time thereafter, but by 1960 a definite policy had emerged. The policy was that the Australian Government would match State Gov-

²⁵ Local government authorities in Australia are established under Acts of State Parliaments, with the exception of the Northern Territory where local governments have been established by ordinance under laws of the Australian Parliament. Australian local government authorities do not play a major role in policy determination with respect to natural disasters.

²⁶ Quoted in R. L. Wettenhall, *Bushfire Disaster: An Australian Community in Crisis*, Angus and Robertson, Sydney, 1975, p. 47.

ernment expenditure on the relief of personal distress and hardship and the restoration of public assets to their pre-disaster condition. The form of such Australian Government assistance was, and still is, that of a matching specific purpose grant to State Governments under section 96 of the Commonwealth Constitution, which states *inter alia* that "... the Parliament may grant financial assistance to any State on such terms and conditions as the Parliament thinks fit". Included in such grants to the States have been funds for the restoration of local government assets damaged or destroyed by natural disasters. Thus the three levels of government in Australia are linked together in the matter of natural disasters by specific purpose grants of the Australian Government.

In terms of the analysis in Section (1) of this chapter, the policy adopted after 1960 was based upon a co-insurance provision. Since the grants to the States were initially on a dollar-for-dollar matching basis, the co-insurance rate was then 50 per cent. Note, however, that the co-insurance rate was applied not only to a State's expenditure on restoration of its assets but also to payments to individuals to relieve personal distress and hardship.

Although the general policy was one of matching grants, there were exceptions. For example, in 1965-66 the Australian Government, in applying the *States Grants (Drought Assistance) Act 1966*, met *all* expenditures by the Governments of New South Wales and Queensland on agreed measures to mitigate the effects of drought. This arrangement was extended to cover Victoria and South Australia with the passing of the *States Grants (Drought Reimbursement) Act 1968*.²⁷ However, all expenditure was met by the Australian Government under these Acts because no assistance was in the form of grants for personal distress and hardship or for the restoration of State and local authority assets. Had assistance under these categories been made available, that assistance would have been met by the Australian Government only on a matching dollar-for-dollar basis.²⁸

Another important exception to the policy of a dollar-for-dollar matching grant occurred when fires in February 1967 caused extensive damage throughout southern Tasmania. In implementing the *Tasmanian Grant (Fire Relief) Act 1967* the Australian Government applied the dollar-for-dollar matching formula only to personal distress and hardship relief up to \$750,000 and then provided *all* funds for other categories of damage. The co-insurance rate of 50 per cent was thus applied only to personal distress and hardship payments up to \$1.5 million damage. The upper limit on the Tasmanian Government's expenditure was then \$750,000, all relief funds in excess of this amount being funded by the Australian Government.

An important aspect of Australian Government policy has been that generally no assistance has been made available for the repair or restoration of *private* assets affected by natural disasters, whether partially damaged or completely destroyed. The first exception to this policy occurred with the 1967 Tasmanian bushfires. The *Tasmanian Grant (Fire Relief) Act 1967* was the first grant from the Australian Government that provided central government funds to *persons* whose assets were damaged or destroyed during a natural disaster. Prior to 1967 assistance for the repair or restoration of assets had been restricted to *public* assets, whether of State or local governments. There have been two other exceptions to this policy. The second exception was the assistance made available under the *Queensland Flood Relief Act 1974* to those Queensland residents whose assets were damaged or destroyed during the widespread flooding that took place in the last month of 1973 and the early months of 1974. We may note in passing that assistance made available under the *New South Wales Flood Relief Act 1974* did *not* include grants for the restoration and repair of the *private* assets of New South Wales residents who were affected by floods at the same time.²⁹

The third exception relating to the use of Australian Government funds for damage or destruction to *private* assets occurred in the provision of assistance to the residents of Darwin following cyclone "Tracy" on Christmas Day 1974. In the case of this disaster, Australian Government assistance did not take the form of a specific purpose payment to a State as the constitutional

²⁷ See Australian Treasury, *Commonwealth Payments to or for the States 1968-69*, Commonwealth Government Printer, Canberra, 1968, pp. 35-6.

²⁸ *Ibid.*, p. 38.

²⁹ Australian Treasury, *Payments to or for the States and Local Government Authorities 1974-75*, A.G.P.S., Canberra, 1974, p. 113.

position of the Northern Territory is not that of a State. In this case the relevant legislation was the *Darwin Cyclone Damage Compensation Act 1975*.

Australian Government assistance can take the form either of loans, which may be interest free to the State Government concerned but for which the recipients of the loans (primary producers, small business enterprises, churches, sporting bodies or other non-profit organisations) are charged a positive but concessional rate of interest by the relevant State Government,³⁰ or of non-repayable grants. Grant assistance may be of a recurrent nature or a capital nature. The only payments of a recurrent nature are those for personal distress and hardship.

Although the Australian Government provides funds following a natural disaster, typically it is left to the State Governments to administer the various schemes that may be implemented in a particular case. This is not to suggest that the Australian Government has no say on the nature of assistance to be provided. What usually happens is that the conditions of Australian Government assistance are jointly agreed upon by the Australian Government and the relevant State Government. Mr McMahon, Commonwealth Treasurer at the time of the Tasmanian bushfires, said in his second reading speech to the *Tasmanian Grant (Fire Relief) Bill 1967*: "There were consultations between the Commonwealth and the State and, as a result, agreement was reached between the two Governments on the terms on which assistance would be made available, the amounts that would be provided under the agreement and the precise measures of assistance to be undertaken by the State."³¹ A clearer statement was given by Mr McMahon in answer to a Question on 13 April 1967. He said: "Both governments are responsible for the terms of the agreement and the amount that is being provided under it."³² In a ten-page press release of 22 March 1967, the Tasmanian Premier, Mr Reece, spoke of the arrangements in much the same way.

A similar situation occurred in the case of the 1974 Queensland floods. Mr Crean, the then Treasurer, in his second reading speech referred to "... measures which the Queensland Government has implemented with the agreement of the Australian Government and which the State is administering".³³ The Queensland Premier, in answering a Question Upon Notice on 13 March 1974, said: "What our Governments have *mutually agreed* to do is to provide, as generously and as speedily as possible, some financial aid to all those in need of assistance."³⁴

In the case of the Darwin cyclone in 1974, there were several legislative actions. First the Australian Parliament passed the *Darwin Cyclone Damage Compensation Act 1975* and the *Darwin Reconstruction Act 1975*. Secondly the Northern Territory Legislative Council passed the *Cyclone Disaster Emergency Ordinance 1975*, the *Cyclone Disaster Relief Fund Ordinance 1975* and the *Cyclone Disaster (Moratorium) Ordinance 1975*. In addition, the Legislative Council subsequently amended the first Ordinance on two separate occasions at the request of the Australian Government. As already noted, in the case of cyclone "Tracy" no specific purpose payment legislation was involved as the Northern Territory has a different constitutional position from that of the Australian States.

Specific purpose payment legislation may state the conditions under which the funds are made available. An example of this procedure is the *States Grants (Schools) Act 1973*. Alternatively, the conditions may be specified in a schedule to the legislation, e.g. the Queensland Parliament's *Tuberculosis Further Agreement Act of 1969*, or the Australian Parliament's *States Grants (Water Resources Measurement) Act 1973*.

In the case of natural disasters, several devices (or forms) have been employed. In the case of the 1967 Tasmanian bushfires, the Australian Government's legislation *Tasmanian Grant (Fire Relief) Act 1967* simply stated: "Payment of an amount (including an advance) . . . is subject to such conditions, if any, as the Treasurer determines." However, the conditions associated with this Act were made known in several ways. First, the second reading speech of the then Treasurer

³⁰ The income to the State Government from this interest charge is to cover administrative costs and any bad debts that may arise from the operation of the loan assistance scheme.

³¹ Commonwealth of Australia, House of Representatives, *Debates*, 1967, Vol. H. of R. 55, p. 1492.

³² House of Representatives, *Debates*, 1967, Vol. H. of R. 54, p. 1216.

³³ House of Representatives, *Debates*, 1974, Vol. H. of R. 88, p. 1183.

³⁴ Queensland, *Parliamentary Debates*, 1974, Vol. 264, p. 2843 (emphasis added).

(Mr McMahon) provided some of the general provisions³⁵ and further information was made known during the debate in both the House of Representatives³⁶ and the Senate.^{37, 38}

More important was the fact that the Tasmanian Parliament on 8-10 March debated the *Fire Damage Relief Bill* 1967, in which some details of the various assistance schemes were announced.³⁹ This Bill received the Royal Assent on 15 March 1967. However, in terms of victims' detailed knowledge of the operations of the various schemes, i.e. the conditions under which they would receive assistance, two sources were crucial. These were, first, the ten-page press release from the Tasmanian Premier's Office of 22 March 1967 and, second, the 21-page brochure "Fire Damage Relief" issued on 14 April 1967.⁴⁰ The details of the conditions under which fire victims would receive assistance were specified, although special cases would have to be treated on their merits.⁴¹

Specific information on assistance for Queensland flood victims became known in much the same way, with one major exception: the Queensland Parliament did not pass complementary legislation as had been done in the case of the Tasmanian bushfires in 1967. The only legislation passed by the Queensland Parliament at this time dealt with the relatively small matter covered by the *Sporting Bodies (Natural Disaster Relief) Act* 1974. This is not to suggest that issues associated with the Queensland floods were not debated in the Queensland Parliament. Information was provided during the parliamentary debate on 5 March 1974,⁴² and further information was given by Ministers' answers to Questions Upon Notice⁴³ and Questions Without Notice.⁴⁴

In the Australian Parliament Mr Crean, the Treasurer at the time, provided details of the general operation of assistance in his second reading speech to the *Queensland Flood Relief Bill* 1974.⁴⁵ Further information was given during the debates in the House of Representatives⁴⁶ and the Senate.⁴⁷ An important summary document in the case of the Queensland floods is the *Authorization and Determination of the Queensland Flood Relief Act* 1974.⁴⁸

Thus we have a situation in which administrative arrangements for almost identical situations (a specific purpose grant to the Tasmanian Government in 1967 for bushfires and a specific purpose grant to the Queensland Government in 1974 for floods) took different forms. The Australian Government document *Authorization and Determination* relating to the *Queensland Flood Relief Act* 1974 provides the sort of information that was provided in the Tasmanian case by the *Fire Damage Relief Act* 1967, the Premier's Press Statement of 22 March 1967 and the brochure "Fire Damage Relief" issued on 14 April 1967.

Wiltshire has written that the methods of Australian intergovernmental administrative relations "defy any general description".⁴⁹ He went on to say that "there is no semblance of any logical pattern, nor are there clearly defined models which are followed in identical situations".⁵⁰

³⁵ House of Representatives, *Debates*, 1967, Vol. H. of R. 55, pp. 1492-4.

³⁶ *Ibid.*, pp. 1975-2000.

³⁷ Commonwealth of Australia, Senate, *Debates*, 1967, Vol. S. 34, pp. 1555-80.

³⁸ Some changes to the conditions of Australian Government assistance had been brought about by the representations of Tasmanian Liberal members of the Australian Parliament. For details see Wettenhall, *op. cit.*, pp. 185-6.

³⁹ Amendments to this Tasmanian Act were made by the *Fire Damage Relief Act* 1970 and the *Fire Damage Relief Act* 1972.

⁴⁰ The introductory paragraph of this brochure read, in part: "This brochure is issued under the authority of the Premier of Tasmania for the guidance of those who suffered loss or damage in the disastrous fires in Southern Tasmania in the month of February, 1967." The headings of this brochure were as follows: General Introduction. Housing. Primary Producers. Businesses. Motor Vehicles. Assistance for Dependents of Deceased Fire Victims. Non-Profit Organisations. Relief in Respect of Rates, Taxes and Other Charges. The Governor's Fire Relief Fund.

⁴¹ For a detailed discussion see Wettenhall, *op. cit.*, Chapters 14 and 15.

⁴² Queensland, *Parliamentary Debates*, 1974, Vol. 264, p. 2626.

⁴³ *Ibid.*, pp. 2843-4, p. 2869 and pp. 898-9.

⁴⁴ *Ibid.*, pp. 3788-9 and p. 3790.

⁴⁵ Commonwealth of Australia, House of Representatives, *Debates*, 1974, Vol. H. of R. 88, pp. 1183-5.

⁴⁶ *Ibid.*, pp. 1255-77.

⁴⁷ Commonwealth of Australia, Senate, *Debates*, 1974, Vol. S. 59, pp. 919-24.

⁴⁸ Detailed information was also provided in circulars and individual letters to flood relief applicants by the various administrative committees such as the Government Flood Damaged Homes Committee.

⁴⁹ K. W. Wiltshire (ed.), *Administrative Federalism: Selected Documents in Australian Intergovernmental Relations*, University of Queensland Press, Brisbane, 1977, p. 8.

⁵⁰ *Ibid.*, p. 9.

A major change in Australian Government policy on natural disasters took place in 1970-71. From 1960 to 1969-70 the Australian Government's policy, essentially, was to provide a dollar-for-dollar matching payment for agreed expenditures by the State Governments. However, we have noted some exceptions to this general policy position. In the 1971-72 Budget Paper *Commonwealth Payments to or for the States 1971-72*, the Australian Government announced a new policy on natural disaster assistance to the State Governments. This policy was made retrospective to take account of payments to the States in 1970-71. We turn now to consider the new policy.

The new policy distinguishes between expenditure on relief and restoration measures in respect of what are described as major disasters, which necessitate expenditure in excess of one-tenth of a State's "base" annual expenditure as defined below, and expenditure on the immediate relief of personal hardship and distress.

Australian Government assistance for the relief of damage from a major natural disaster is now conditional on the State Government undertaking expenditure from its own sources up to a "base" amount in each financial year for the disaster concerned. Once that "base" has been reached, the Australian Government meets in full all the remaining expenditure on agreed relief and restoration measures. In 1971-72 these "base" expenditures were specified as shown in Table II-1, and have remained constant since then.

Table II-1

ANNUAL "BASE" EXPENDITURE BY THE STATE GOVERNMENTS ON AGREED MEASURES FOR NATURAL DISASTER RELIEF, 1970-70 to 1977-78

State	"Base" Expenditure \$
New South Wales (NSW)	5,000,000
Victoria (Vic)	3,500,000
Queensland (Q'ld)	2,000,000
South Australia (SA)	1,500,000
Western Australia (WA)	1,500,000
Tasmania (Tas)	600,000

Source: Australian Treasury, *Payments to or for the States and Local Government Authorities 1977-78*, A.G.P.S., Canberra, 1977, p. 87.

In terms of the analysis in Section (1) of this chapter, the "base" expenditure requirement is in the nature of a deductible although, as with the co-insurance provision, State expenditure on personal distress and hardship relief is included in the "base". The change in policy in 1971 may thus be viewed as a change from a co-insurance to a deductible provision, subject to one exception to be discussed shortly.

This "base" expenditure concept is employed also in determining grants to local governments, with the slight difference that the "base" relates only to expenditures for the restoration of local government assets. The "base" expenditure for a local government body was set for the 1974 Queensland and New South Wales floods as 25 per cent of total damage to the local government body's assets, up to a maximum of \$100,000 damage. If damage exceeded \$100,000 then the "base" remained constant at \$25,000. Given that local governments are not expected, or required, to allocate funds to *persons* and that their expenditures are applied only to restoration of their own assets, we can interpret this "base" requirement as a co-insurance rate of 25 per cent if damage is less than \$100,000 and the \$25,000 as a deductible if damage exceeds \$100,000.

Prior to 1971, the arrangements between the Australian Government and the State Governments were that the Australian Government made matching payments for State expenditures on a dollar-for-dollar basis. We have seen that this was not an invariant policy: it was a policy subject to "certain qualifications which sometimes varied from case to case . . .".⁵¹

⁵¹ Australian Treasury, *Commonwealth Payments to or for the States 1971-72*, A.G.P.S., Canberra, 1971, p. 57.

The "base" expenditures listed in Table II-1 were designed to overcome "the numerous difficulties" associated with the matching grant formulation of Australian Government assistance. Two difficulties have been mentioned: first, the problem of determining "the real need for the Commonwealth's participation";⁵² secondly, it was hoped that the "base" formulation of assistance would overcome the problems that would occur when "the expenditures are considered to be beyond the capacity of the State concerned to meet from its own resources".⁵³

The first difficulty is thus concerned with the elimination of Commonwealth involvement when damage is quite small. The matching grant or co-insurance formulation involves the Australian Government irrespective of the magnitude of the disaster. The second difficulty is concerned with the other extreme case, when the disaster is major and damage is quite large; the equal matching grant formulation results in a very large State Government commitment.

However, this does not mean that the matching grant or co-insurance formulation has disappeared from present policy. Under the second element of the new policy noted above, matching grants on a dollar-for-dollar basis are still paid for the purpose of "immediate relief of personal hardship and distress, except where such expenditure is of a very minor nature".⁵⁴

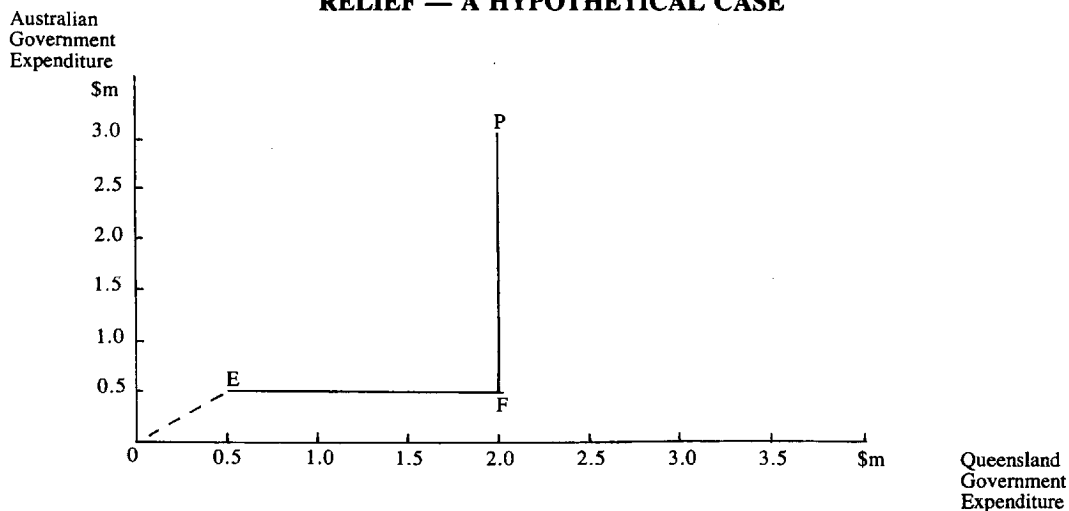
In fact, the broad outlines of present policy were implemented in the case of the Tasmanian bushfires of 1967. Recall that in that case the Australian Government matched dollar-for-dollar Tasmanian Government expenditure on personal distress and hardship up to \$750,000 and then funded all expenditures in excess of that figure. In the terminology of the policy on natural disasters which has applied with effect from 1970-71, an amount of \$750,000 was Tasmania's "base" expenditure for 1966-67.

The policy can be explained and illustrated by a numerical example.

In Figure II-1, we measure expenditure by the Queensland Government for natural disaster assistance on the X-axis. Australian Government assistance is measured on the Y-axis. From Table II-1 we know that Queensland's "base" expenditure is \$2,000,000. Assume that expenditure by the Queensland Government on personal distress and hardship is \$500,000. Given the dollar-for-dollar matching grant from the Australian Government for this category of assistance, the total expenditure on personal hardship and distress will thus be \$1,000,000. This situation is depicted by the point E in Figure II-1.

Figure II-1

RELATIONSHIP BETWEEN AUSTRALIAN GOVERNMENT AND QUEENSLAND GOVERNMENT ASSISTANCE FOR AGREED MEASURES ON NATURAL DISASTER RELIEF — A HYPOTHETICAL CASE



⁵² *Ibid.*

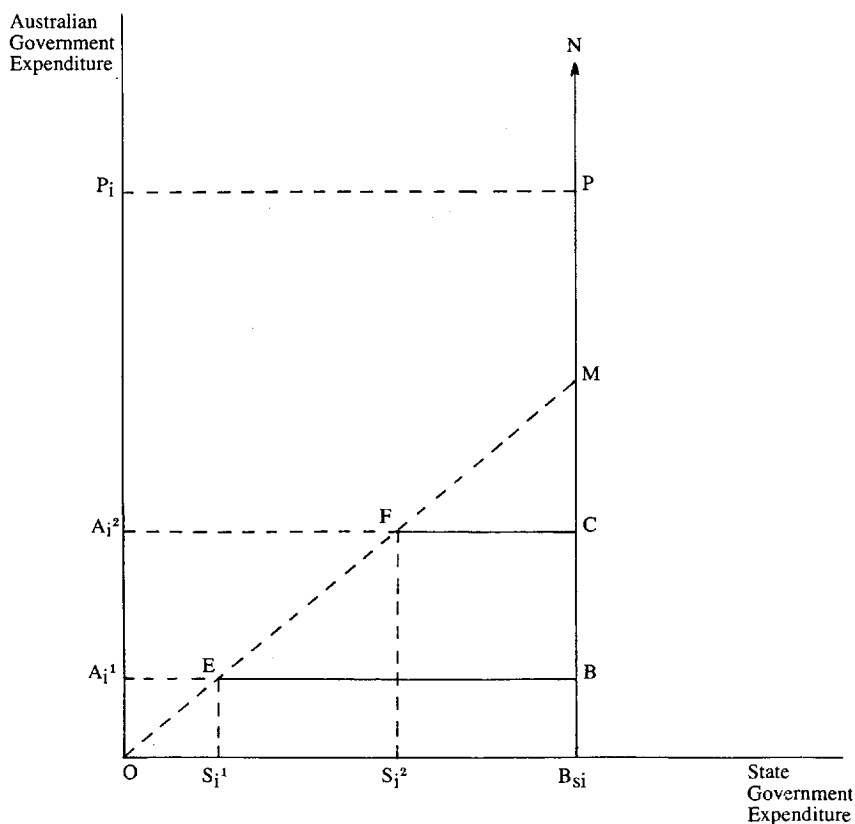
⁵³ Australian Treasury, *Payments to or for the States and Local Government Authorities 1977-78*, A.G.P.S., Canberra, 1977, p. 87.

⁵⁴ *Ibid.*

Table II-2
EXPENDITURE BY QUEENSLAND AND AUSTRALIAN GOVERNMENTS ON A
NATURAL DISASTER — A HYPOTHETICAL EXAMPLE
 \$

Government Providing Relief	Category of Assistance		
	Personal Distress and Hardship	Other	Total
Queensland Government	500,000	1,500,000	2,000,000
Australian Government	500,000	2,500,000	3,000,000

Figure II-2
RELATIONSHIP BETWEEN AUSTRALIAN GOVERNMENT AND STATE
GOVERNMENT ASSISTANCE FOR AGREED MEASURES ON NATURAL DISASTER
RELIEF



Now assume that total damage from a natural disaster attracting relief is \$5,000,000; this figure includes the \$1,000,000 for personal distress and hardship. In other words, relief of \$4,000,000 is payable (from *both* governmental sources) for categories of relief other than personal distress and hardship. For these other categories of relief, no Australian Government assistance is payable until the Queensland "base" expenditure of \$2,000,000 has been met. Given that \$500,000 has been allocated by the Queensland Government for personal distress and hardship, the Queensland Government must allocate a further \$1,500,000 to other categories of relief before

further Australian Government assistance is given. EF in Figure II-1 indicates this expenditure of \$1,500,000 on other categories of relief. At the point F the Queensland Government has met its "base" expenditure of \$2,000,000.

All assistance in excess of the "base" is met by the Australian Government. Given that at the point F the Queensland Government has met \$2,000,000 the distance FP represents the amount of further assistance, \$2,500,000, that is funded by the Australian Government. The shares of assistance provided by the two Governments are summarised in Table II-2.

Note that total assistance from both Governments is indicated in Figure II-1 at point P by the summation of the relevant intercepts on the two axes, i.e. \$2,000,000 and \$3,000,000 on the X-axis and the Y-axis respectively.

We have considered in the above example a specific case of a natural disaster. However, it is of value to note the *general* features of present policy. Consider Figure II-2.

Because the dollar-for-dollar matching grant formula applies to personal distress and hardship relief, if all expenditure is for this type of relief the 45° line OM is the graph that indicates the relationship between the assistance provided by the Australian Government and the State Government up to the "base" expenditure, OB_{Si} of State *i*. Thus the point E in Figure II-1 is a specific point on the 45° line in that figure. Once State expenditure reaches B_{Si} no further contribution is made by the State. Expenditures beyond B_{Si} are met entirely by the Australian Government. This is indicated by the line MN in Figure II-2. Where all assistance is for the relief of personal distress and hardship, OMN is thus the relevant graph.

However, the Australian Government provides assistance for *other* relief and restoration measures that may be necessary following a major natural disaster. These other categories vary from disaster to disaster. Such other assistance, as well as assistance for personal distress and hardship, is included in the calculation of a State's "base" expenditure.

Consider now the other extreme case where no assistance is provided for personal distress and hardship. Under these circumstances no matching grant is payable. Before any Australian Government assistance is made available, the State Government must incur expenditure up to the "base" amount, OB_{Si} . All relief in excess of the State's "base" expenditure (OB_{Si}) is then provided by the Australian Government. In this limiting case the relevant graph is $OB_{Si}N$.

We turn now to consider some intermediate cases between the two limiting cases we have discussed so far. First assume that the State's expenditure on personal distress and hardship is greater than zero, but less than the State's "base". Such a case is indicated in Figure II-2 as OS_i^1 . The matching grant formula applies and hence Australian Government assistance to State *i* is OA_i^1 in Figure II-2. Expenditures on relief for categories other than that of personal distress and hardship up to the "base" OB_{Si} are borne entirely by the State Government. This is indicated by EB in Figure II-2. If agreed measures on relief and restoration exceed the State's "base" expenditure then the Australian Government meets all such relief payments in excess of the "base" amount. This is illustrated by the line BN in Figure II-2. The relevant graph is thus $OEBN$.

Now consider another intermediate case, in which the State's expenditure on personal distress and hardship is OS_i^2 . The matching grant formula applies and hence Australian Government assistance is OA_i^2 . Assistance for relief categories other than that of personal distress and hardship will then be borne by the State Government up to the "base" amount OB_{Si} (FC in Figure II-2). All expenditures in excess of the "base" amount OB_{Si} are then borne by the Australian Government, so that the segment CN of the graph applies. The graph for the case in which the State spends OS_i^2 on personal distress and hardship is thus $OFCN$.

It is therefore clear that all intermediate cases between the two limiting cases can be depicted as graphs beginning from the origin of Figure II-2, moving along the 45° line a specified distance (determined by the absolute expenditure by the State on personal distress and hardship), then as a line horizontal to the X-axis until the State's "base" expenditure has been reached, and then as a line vertical to the horizontal axis at the level of the State's "base" expenditure. The graph for each intermediate case consists of these three distinct segments.

As with Figure II-1, assistance by both Governments can be determined in Figure II-2 by summing the two relevant intercepts on the two axes. Consider the point P in Figure II-2. State

expenditure is the "base" OB_{sj} . Australian Government assistance is OP_i . Total Government assistance is then given by $OB_{sj} + OP_i$.

We need to clarify some other points about the specific purpose payments for natural disasters. First, the "base" expenditures to which we have been referring are *annual* amounts. That is to say, if a natural disaster occurs in Year 1 and relief payments are made in Years 1, 2, and 3, then the policy we have been discussing is applied on the basis of three separate annual amounts. In other words, Figure II-2 refers to the situation in a particular year.

Secondly, the financial commitment of the Australian Government is not open-ended. The operation of the Australian Government's policy on natural disasters, as depicted in Figure II-2, is subject to the constraint that Australian Government expenditure (as measured by the intercept on the Y-axis of Figure II-2, or more correctly, the summation of such intercepts for the number of years for which relief payments are made in respect of a particular natural disaster), does not exceed the appropriation of the particular specific purpose payment Act.

Thirdly, Australian Government funds are for "agreed" measures given the particular circumstances of each natural disaster. For example, assistance in the form of grants for personal distress and hardship is made available following cyclones, floods, storms and bushfires. Grant assistance is also made available for the restoration of State, local and semi-government authority assets damaged under similar circumstances as mentioned above. Primary producers subject to drought, flood or bushfire are eligible for loan assistance on concessional terms, rail rebates and subsidies on road transport of fodder and stock. Following a flood, concessional loan assistance is made available to small business enterprises, churches, sporting bodies and other non-profit voluntary organisations. Grant assistance for the restoration of private assets has also been made available following the 1967 Tasmanian bushfires and the 1974 Queensland floods.

Fourthly, in determining whether a lower-level government has reached its "base", any element of assistance (whether grant or loan) for any entity (government, persons, business enterprise, primary producer or voluntary body) is taken into account. What this means is that the term "base expenditure", which has been employed by the Australian Treasury since the inception of the policy in 1970-71, is not strictly correct. Given that assistance in the form of loans is included, the correct term is "outlay". However, in this monograph we will follow the Australian Treasury's usage of the term "expenditure" to describe these "base outlays".

We turn now to consider the implications of the present policy of the Australian Government as it affects damage to local government assets in Australia. As noted above, when the "base" expenditure requirement for State Governments was formalised with effect from 1970-71, a similar "base" expenditure requirement was introduced for local governments affected by a natural disaster. Unlike the "base" expenditure of a State Government, the "base" expenditure for a local government authority is not fixed and invariant, as is the case for a State Government. In fact, the "base" expenditure requirement for a local government is a combination of a co-insurance rate and a deductible.

In the case of a local government, the "base" expenditure has been set at 25 per cent of damage up to an expenditure level on the restoration of assets of \$100,000. The 25 per cent is the co-insurance rate for asset damage up to \$100,000. If damage exceeds \$100,000 then the local government's "base" is fixed at \$25,000.⁵⁵ Thus \$25,000 is a deductible amount. What this means is that if a natural disaster occurs and the destruction to a local authority's assets is relatively small, say \$80,000, then the local government must meet 25 per cent of this (\$20,000) from its own funds, while the Australian Government will provide the remainder (\$60,000). In this hypothetical case, the local government's "base" expenditure requirement is \$20,000. In other words the Australian Government provides a matching grant of three dollars for each dollar spent by the local government on natural disasters, the Australian Government's limit being \$75,000 for such a matching grant.⁵⁶ Once the Australian Government's grant has reached

⁵⁵ There is provision for a local government, which may experience difficulty in funding this "base" expenditure from its own revenue sources, to apply for its "base" expenditure to be decreased. No such administrative discretion exists in the case of "base" expenditures for State Governments.

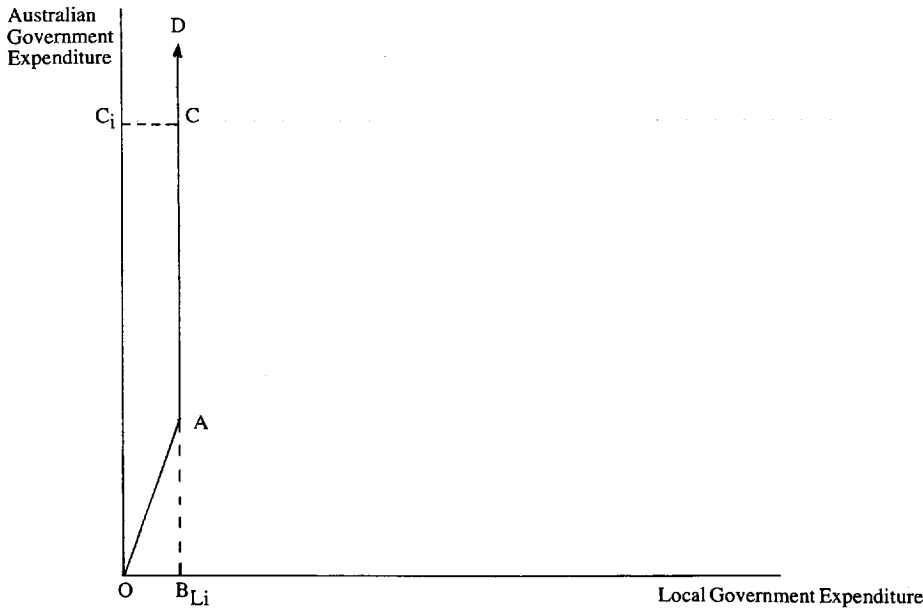
⁵⁶ In reality the Australian Government's assistance to local governments takes the form of a grant to the relevant State Government, which the State Government is required to pass on to the local governments under the Australian Government's natural disaster policy. Note that Australian Government assistance for the restoration of local and semi-government authority assets takes the form of grants.

\$75,000, which implies that damage has reached \$100,000 and that the local government has reached its maximum “base” expenditure of \$25,000, then the deductible provision becomes operable and the Australian Government provides all further necessary funds to restore the local government’s assets to their pre-disaster level. This does not imply that the Australian Government’s commitment is open-ended: Australian Government assistance is constrained by the amount agreed and authorised by the relevant Act of the Australian Parliament.

We can depict the mechanism of the Australian Government’s natural disaster policy as it affects local governments in a diagram similar to Figure II-2. In Figure II-3 we depict local government expenditure on the X-axis. As with Figure II-2 we depict the Australian Government’s expenditure on the sub-national government’s assets on the Y-axis.

Figure II-3

RELATIONSHIP BETWEEN AUSTRALIAN GOVERNMENT ASSISTANCE AND LOCAL GOVERNMENT EXPENDITURE ON THE RESTORATION OF LOCAL GOVERNMENT ASSETS



OB_{Li} is the “base” expenditure or the deductible of the i th local government where asset damage exceeds \$100,000. This will always be \$25,000 unless the particular local government has successfully applied to have its “base” expenditure requirement decreased. The segment OA of the graph OAD indicates the range over which the matching grant of three dollars from the Australian Government for each dollar provided by the local government is applicable.⁵⁷ Once the point A has been reached the local government has reached its “base” expenditure requirement and is not required to contribute further from its own funds to the restoration of any assets damaged by a natural disaster; all further restoration is met from the funds of the Australian Government. Segment AD of the graph OAD thus becomes the relevant relationship when the co-insurance provision no longer applies. As with Figure II-2, total government resources allocated to restoration at any point in Figure II-3 are indicated by the sum of the intercepts on the X and Y-axes. For example, total assistance at point C is given by $OB_{Li} + OC_i$.

Unlike the conditions pertaining to Australian Government assistance to State Governments, there is always a simple relationship (indicated by OAD in Figure II-3) between expenditures on natural disasters by local governments and assistance from the Australian Government.

⁵⁷ The gradient of OA is 3.

This is because assistance for local governments is restricted to one category of assistance, namely, restoration of local government assets. The more complex and variable relationship between State Government expenditure and Australian Government expenditure illustrated in Figure II-2 arises because the Australian Government treats State Government expenditures on personal distress and hardship in a different fashion from other expenditures. If no such distinction was made by the Australian Government, then the relationship would be as simple as that indicated in Figure II-3. That is to say, the relationship would be that indicated by OMN in Figure II-2.

(3) Natural Disaster Relief and Vertical Imbalance

One of the reasons that was advanced for the adoption of the new deductible provision policy in respect of natural disaster relief from 1970-71 rather than the co-insurance policy was that the deductible approach would overcome the problems that occur when "the expenditures are considered to be beyond the capacity of the State concerned to meet from its own resources".⁵⁸ This is clearly related to the problem of vertical imbalance, as the central government in effect takes on the important role of insurer for the assets of sub-national governments. This happens because it is considered that the sub-national government has insufficient resources to self-insure its own assets.

In this section we examine some government expenditure data on natural disasters in the period 1970-71 to 1975-76. Our objective is to compare the effects of three different policies on natural disasters. These are as follows:

- (a) State Governments meet specified "base" expenditures from their own resources. This is the Australian Government policy on natural disasters which has applied from 1970-71.
- (b) The Australian Government provides a dollar-for-dollar matching grant for State Government expenditures on natural disasters. This is the policy which applied before 1970-71.
- (c) State Governments meet all necessary expenditures from their own revenue sources, i.e. the Australian Government provides no assistance to State Governments in respect of natural disaster expenditures. This policy requires State Governments to carry the risks of self-insurance for damage to their own assets.

Each policy alternative affects State Governments' own revenue positions to varying degrees. Under each policy the State Governments must finance, from their own sources, some expenditures following a natural disaster. This can be done in either of two ways. First, the State Governments may increase those tax rates over which they have control in such a way as to increase their revenues to the extent necessary to meet the expenditure requirements, while holding constant the standards of service of all other expenditures. Secondly, the State Governments may hold all taxes and charges constant and finance the expenditure requirement by reducing all other expenditures.⁵⁹ Irrespective of which budgetary strategy is implemented, the States' residents will bear the cost either as taxpayers or as the recipients of public goods or services.

For the purpose of our comparison of the three alternative policies, we will assume that the States finance their natural disaster expenditures by increasing the tax rates applicable to the revenue bases to which they have access.

In Table II-3, we present the results of calculating the extent to which State Governments must increase tax rates so as to finance from their own revenue sources the expenditures associated with policies (a), (b) and (c).⁶⁰

It could be argued that the State revenue data which we have employed overestimate the percentage increase in burdens required of State residents. This is because the data relate only to "taxation" as defined by the Australian Bureau of Statistics.⁶¹ Clearly State Governments could

⁵⁸ Australian Treasury, *Payments to or for the States and Local Government Authorities 1977-78*, op. cit., p. 87.

⁵⁹ Clearly the State Governments could implement some combination of these two budgetary reactions.

⁶⁰ If we had assumed that State Governments financed natural disaster expenditures by holding taxes constant and decreasing expenditure on other public goods or services, similar calculations could be made to indicate the percentages by which expenditure on those other goods or services would be reduced.

⁶¹ Australian Bureau of Statistics, *Public Authority Finance: Taxation 1976-77*, Australian Bureau of Statistics, Canberra, 1978.

also increase "charges" for the various goods and services which they produce.⁶² Although we have made separate calculations for "taxes and charges" we present only the results for percentage increases in "taxes", as it is likely that governments may conceive of tax rates as being more readily subject to variation than the prices of various government goods and services.

The time series data for policy (a), i.e. the deductible policy which has applied since 1970-71, indicate the worst position that any State Government in Australia faced in any one year. In order to finance its "base" expenditure of \$5,000,000, in 1970-71 the New South Wales Government would have had to increase its tax rates by 1.217 per cent. To finance its "base" expenditure of \$3,500,000, the Victorian Government would have had to increase its tax rates by 1.147 per cent. The relevant percentage increases for the Governments of Queensland, South Australia, Western Australia and Tasmania would have been 1.674 per cent, 2.089 per cent, 1.940 per cent and 2.666 per cent respectively.

Two points should be noted about the figures for policy (a) in Table II-3. First, the calculations we have made relate to a hypothetical situation, in that natural disasters did not occur in each State in each of the years from 1970-71 to 1975-76. The purpose of the calculations with respect to policy (a) is to measure the largest possible increase in tax rates that would need to be applied if a natural disaster did occur in a particular year. Secondly, the percentage increases in tax rates have fallen through time. This is a result of the fact that the "base" expenditures remained constant in money terms until 1977-78. No attempt was made to maintain the value of the State Governments' deductibles in real terms by using an indexing procedure.

The calculations we have made with respect to policy (b), i.e. the dollar-for-dollar matching grant or 50 per cent co-insurance policy, are not hypothetical in the same sense as the calculations for policy (a). These calculations relate to hypothetical expenditures by the State Governments on those natural disasters that did occur in the years 1970-71 to 1975-76, on the assumption that the pre-1970-71 policy still applied.⁶³ But the calculations are hypothetical in the sense that in the years 1970-71 to 1975-76 the policy on natural disasters was *not* a 50 per cent co-insurance rate policy. The calculations thus indicate the percentage increase in tax rates that the State Governments would have had to impose if the pre-1970-71 policy had still applied.

In some cases the co-insurance policy which was in force before 1970-71 would have involved a lower burden on State residents than the deductible policy which applied from 1970-71. This would have happened when total government expenditure following a natural disaster was small. Such a case occurred in Victoria in 1970-71. On the other hand, when a natural disaster involves large government expenditures, as was the case in Queensland in 1973-74, the deductible policy involves a lower burden on the residents of the State than would have been the case if the 50 per cent co-insurance policy had applied. The deductible policy in 1973-74 required the Queensland Government to increase tax rates by 0.749 per cent, whereas the 50 per cent co-insurance rate policy would have required that taxes be increased by 5.352 per cent.

Policy (c), a policy which would require State Governments to assume sole responsibility for natural disaster expenditure, can be thought of as a *co-insurance policy with a 100 per cent State rate*. Thus the State Governments must carry all self-insurance themselves. The results of the calculations for policy (c) in Table II-3 are thus twice those for policy (b), the 50 per cent co-insurance policy.

It is clear from Table II-3 that, in the years 1970-71 to 1975-76, Queensland was subject to more natural disaster expenditure relative to its tax bases than other States. The two phenomena responsible for this were cyclone "Althea", which caused extensive damage in Townsville in the year 1970-71, and the widespread floods throughout Queensland in 1973-74. Under these circumstances, it is useful to consider the various policies as they affect vertical imbalance with special reference to Queensland.

As noted previously, the data for Queensland under policy (a) indicate the greatest extent to which tax rates would have had to be raised to finance the Queensland Government's "base"

⁶² See Australian Bureau of Statistics, *Public Authority Finance: State and Local Authorities 1975-76*, Australian Bureau of Statistics, Canberra, 1978.

⁶³ Any gaps in the data for policy (b), e.g. Victoria and South Australia in 1971-72, indicate that the Governments of those States did not incur any natural disaster expenditures in that year.

Table II-3

PERCENTAGE INCREASE IN STATES' TAX RATES NECESSARY UNDER ALTERNATIVE DISASTER RELIEF POLICIES

Year	New South Wales			Victoria			Queensland		
	Policy (a) (B _{si} /R _{si})%	Policy (b) (E _{si} /R _{si})%	Policy (c) (B _{si} /R _{si})%	Policy (a) (B _{si} /R _{si})%	Policy (b) (E _{si} /R _{si})%	Policy (c) (B _{si} /R _{si})%	Policy (a) (B _{si} /R _{si})%	Policy (b) (E _{si} /R _{si})%	Policy (c) (B _{si} /R _{si})%
1970-71	1.21714	1.44937	2.89874	1.14771	0.00705	0.01410	1.67382	5.40184	10.80368
1971-72	0.85835	0.12489	0.24978	0.84502	—	—	1.18436	2.58487	5.16974
1972-73	0.66430	0.13419	0.26838	0.68065	0.01118	0.02236	0.92784	0.51402	1.02804
1973-74	0.55921	0.34442	0.68884	0.52654	0.01294	0.02588	0.74890	5.35217	10.70434
1974-75	0.44298	0.78097	1.56194	0.41553	0.54998	1.09996	0.64488	4.46448	8.92896
1975-76	0.35791	0.72288	1.44576	0.33773	0.47292	0.94584	0.50502	0.97898	1.95796
South Australia									
1970-71	2.08879	—	—	1.93969	0.26121	0.52242	2.66631	0.53326	1.06652
1971-72	1.39504	—	—	1.41174	0.01694	0.03388	1.87958	0.15663	0.31326
1972-73	1.13397	0.04460	0.08920	0.20498	0.03655	0.07310	1.52424	—	—
1973-74	0.87260	0.03170	0.06340	0.96767	0.01322	0.02644	1.19211	—	—
1974-75	0.62570	0.12848	0.25696	0.73649	0.00098	0.00196	0.94566	0.01418	0.02836
1975-76	0.50332	0.06090	0.12180	0.57539	1.11722	2.23444	0.76576	0.00830	0.01660
Tasmania									

Notes: B_{si} = "base" expenditure in the relevant State.

E_{si} = hypothetical State expenditure on natural disaster relief in the relevant State based on policy in force before 1970-71.

H_{si} = hypothetical State expenditure on natural disaster relief in the relevant State if State Government were to have sole responsibility for disaster relief.

E_{si} = 2.E_{si}

R_{si} = revenue from taxes in the relevant State.

H_{si} = the sum of the intercepts on the X and Y axes from any point in Figure II-2.

Sources: (1) B_{si} — Australian Treasury, *Payments to or for the States and Local Government Authorities 1974-75*, A.G.P.S., Canberra, 1974, p. 112.

(2) E_{si} — *All State Governments: 1970-71 Commonwealth Grants Commission Thirty-ninth Report (1972) and Special Report (1972)*, Government Printer, Melbourne, 1972, Table 1, pp. 90-1.

1971-72 *Commonwealth Grants Commission Fortieth Report 1973*, A.G.P.S., Canberra, 1973, Table 1, pp. 88-9.

1972-73 *Commonwealth Grants Commission Forty-first Report 1974 on Special Assistance for States*, A.G.P.S., Canberra, 1974, Table 1, pp. 88-9.

1973-74 *Commonwealth Grants Commission Forty-second Report 1975 on Special Assistance for States*, A.G.P.S., Canberra, 1975, Table 4.1, pp. 86-7.

1974-75 *Commonwealth Grants Commission Forty-third Report 1976 on Special Assistance for States*, A.G.P.S., Canberra, 1976, Table 4.1, pp. 78-9.

1975-76 *Commonwealth Grants Commission Forty-fourth Report 1977 on Special Assistance for States*, A.G.P.S., Canberra, 1977, Table 4.2, pp. 84-5.

Australian Government:

1970-71 & 1971-72 Australian Treasury, *Payments to or for the States and Local Government Authorities 1975-76*, A.G.P.S., Canberra, 1975, Table 158, pp. 236-7.

1972-73

Australian Treasury, *Payments to or for the States and Local Government Authorities 1976-77*, A.G.P.S., Canberra, 1976, Table 120, p. 151.

1973-74, 1974-75 Australian Treasury, *Payments to or for the States and Local Government Authorities 1977-78*, A.G.P.S., Canberra, 1977, Table 117, p. 138.

& 1975-76

NSW: Australian Bureau of Statistics, *Public Authority Finance: Taxation 1976-77*, Australian Bureau of Statistics, Canberra, 1978, Table 9.

Vic: *ibid.*, Table 10.

Qld: *ibid.*, Table 11.

SA: *ibid.*, Table 12.

WA: *ibid.*, Table 13.

Tas: *ibid.*, Table 14.

expenditure of \$2,000,000. The data for policy (b), the 50 per cent co-insurance policy, indicate the extent to which the Queensland Government's tax rates would have had to be raised to enable the Queensland Government to meet one-half of the public expenditures that were in fact undertaken. It is clear that, if this policy had been in operation at the time, the years 1970-71, 1973-74 and 1974-75 would have been the years in which the greatest burden would have been placed on Queensland taxpayers. More specifically, tax rates would have had to increase by 5.402, 5.352 and 4.464 per cent respectively. Because policy (c) is a policy which would involve 100 per cent responsibility for State Governments compared to the 50 per cent responsibility under policy (b), the same conclusions can be drawn for policy (c) as have been drawn for policy (b).

The central question is as follows: if policies (b) or (c) had been in operation in the years 1970-71 to 1975-76, could the State Governments with the taxes under their control have met their constitutional responsibilities in the matter of natural disasters? No absolutely final answer can be given to this question; clearly it is a matter of judgment. However, it is our judgment that even policy (c), involving sole State Government responsibility, would not have imposed an unmanageable burden on the revenue resources of the State Governments. It should be understood that the percentage increases in Table II-3 have a once-for-all characteristic. To finance all disaster expenditure in 1973-74 following the 1973-74 Queensland floods, the Queensland Government would have had to increase revenue from all its taxation sources by 10.704 per cent. In the following year the increase would have fallen to 8.929 per cent and in 1975-76 the increase would have fallen further to 1.958 per cent. The increases were thus not cumulative.

From the data for the years 1970-71 to 1975-76 on public expenditures for natural disasters, we conclude that from the perspective of vertical imbalance there is no compelling case to indicate that a deductible policy rather than a co-insurance policy, even one involving a co-insurance rate of 100 per cent, is appropriate.

However, even if the Australian Government considers that the present deductible policy is the appropriate mechanism to encourage State Governments to behave efficiently in the location of their assets, the existing deductible policy is not above criticism. First, the deductibles for the State Governments remained constant in money terms since the inception of the deductible policy in 1970-71 until 1977-78 and, secondly, those deductibles take no account of the horizontal imbalance that exists in Australia.

In the next section of this chapter we calculate the appropriate per capita and total deductibles for the States necessary to take account of these two factors (see Tables II-12 and II-13). We can use these data in the present context to examine what such a policy implies with respect to the problem of vertical imbalance. In Table II-4 we have calculated the percentage increases that State Governments would need to apply to tax rates so that horizontally equalising and indexed deductibles would be met from the taxation revenue sources over which State Governments have control.

Table II-4
PERCENTAGE INCREASES IN STATE TAX RATES NECESSARY TO RAISE INDEXED AND HORIZONTALLY EQUALISED "BASE" EXPENDITURES, 1970-71 to 1974-75

Year	NSW	Vic	Q'd	SA	WA	Tas
1970-71	1.168225	1.197891	1.295104	1.488399	1.298334	1.492259
1971-72	0.888650	0.950655	1.025469	1.091089	1.016562	1.122145
1972-73	0.737025	0.822249	0.919886	0.992080	0.925143	1.006641
1973-74	0.706682	0.726656	0.860085	0.926967	0.908848	0.921496
1974-75	0.660221	0.677869	0.892063	0.778772	0.830552	0.915769

Sources: Table II-13 and R_{sj} sources as in Table II-3.

The data in Table II-4 are directly comparable to the data in Table II-3 relating to policy (a). It is our view that a policy on natural disaster assistance which required State Governments to meet an indexed and horizontally equalised deductible, such that it involved the percentage increases in tax rates indicated in Table II-4, is not a policy that poses any significant problems of vertical balance.

We now address the question whether local governments are capable of financing from their own sources the costs of restoring assets damaged by natural disasters. To answer this question we consider data relating to the nine local government authorities in the catchment of the Brisbane River, all of which experienced damage to their assets as a result of flooding in 1973-74. Our analysis is constrained by the availability of appropriate data on damage to local government assets.

As with the previous analysis relating to State Governments, we are concerned only with those revenues over which local governments have control. In other words, we are concerned with those local government tax bases for which the local governments have power to vary the tax rates.

The Australian Bureau of Statistics has compiled a cross section and time series data file on all local government authorities in Australia.⁶⁴ Our interest relates only to time series revenue items in that data bank. Furthermore, given our concern with tax bases from which a local government can raise additional revenue, not all the items included in "Revenue — Ordinary Services" in the Australian Municipal Information System (AMIS) data file are relevant. Specifically, we have excluded all revenue items other than "Rates and Penalties". Some of the items we have excluded, in particular "Reimbursement for Work Done", "Government Grants — Roads", "Government Grants — Other" and "Other Revenue", are such that their magnitudes are determined by bodies other than the local government itself.⁶⁵ The other items we have excluded, for example "Licences, Fees and Fines", "Charges for Sanitary and Garbage" are, in effect, prices for services provided by local governments. We exclude such items for the same reason that we excluded the revenues from priced goods and services provided by State Governments; the relevant government may not view these charges as being variables for the purpose of financing restoration measures for public assets. However local governments could increase these charges of their own volition and it could be argued that the calculations we have made would overestimate the extent to which local governments would have to place additional burdens on their constituents.

Columns (1) and (3) of Table II-5 indicate the percentage *increases* in tax rates which would be necessary for the specified local governments to finance, from their own taxation sources, the local government "base" expenditure (BL_i), without decreasing (in quantity or quality) the other services they provided to their constituents in the years 1973-74 and 1974-75.⁶⁶ We refer to this as policy (a), as it incorporates a deductible provision similar to that of policy (a) used in discussing State Governments. The calculations have been made on the assumption that no local government in the Brisbane River valley applied for, and was granted, a decrease in its "base" expenditure. Thus the calculations indicate the worst situation that could occur under the Australian Government policy on natural disasters that has applied from 1970-71. Not surprisingly, the local government "base" expenditure requirement has markedly different effects on different local governments. To meet the "base" expenditure requirement in 1973-74, the Brisbane City Council would have had to increase its tax rates by 0.138 per cent.

At the other extreme, the Kilcoy Shire Council in 1973-74 would have had to increase its tax rates by 22.321 per cent to meet the "base" expenditure requirement without decreasing its other services to the Shire's residents. This differential pattern occurred also in 1974-75. Taking all nine local government authorities into account, we have been able to calculate that, if these local governments had been consolidated into one authority and the total "base" expenditure required of that one local government were the same as the total "base" expenditures required of the nine local governments in the Brisbane River valley, then the extent to which tax rates would have had to be increased would have been 1.019 per cent and 0.789 per cent in 1973-74 and 1974-75 respectively. Thus it is clear that there is considerable variation around the mean of the tax rate increases necessary to finance local government "base" expenditures in the Brisbane River valley (see columns (1) and (3) of Table II-5).

⁶⁴ For details see Australian Bureau of Statistics, *Australian Municipal Information System Manual*, 2nd. edn, Australian Bureau of Statistics, Canberra, 1977.

⁶⁵ *Ibid.*, pp. 22-5.

⁶⁶ Data limitations have prevented us from extending this analysis further through time.

In columns (2) and (4) of Table II-5, we have calculated the extent to which the nine local governments in the Brisbane River valley would have had to increase their tax rates so as to finance the restoration of their assets entirely from their own sources. We describe this policy alternative as policy (c) as it has the same characteristic of a 100 per cent co-insurance rate as did policy (c) in the context of State Governments. As with policy (a), we have calculated the extent to which tax rates would have had to be increased if the nine local governments had been consolidated into a single local authority. Those increases would have been 25.625 per cent and 19.818 per cent in 1973-74 and 1974-75 respectively. It is clear that there is considerable variation around the mean, the highest necessary increase being 58.231 per cent in the Shire of Moreton in 1973-74 and 86.224 per cent in the City of Ipswich in 1974-75.

On the basis of these data, we consider that some local governments would have had considerable difficulty in self-insuring their own assets. A co-insurance rate of 100 per cent could pose serious problems for local governments in the context of vertical imbalance. However, the present deductible policy is not above criticism. There is no justification for the extreme variations in increases in tax rates which local governments must impose to finance the present deductible from their own sources (see columns (1) and (3) of Table II-5). The variations arise because the deductible makes no allowance for the fact that local government jurisdictions vary in taxable capacity. If it is considered that a deductible policy as opposed to a co-insurance policy is appropriate, then the absolute value of the local government deductibles could be determined consistently by specifying a uniform per capita deductible that is to be met from each local government's own resources. Let us assume that the appropriate per capita deductible is the same as the average specified for the State Governments of the Grants Commission's "standard states" of New South Wales and Victoria in 1970-71, when the present natural disaster policy was introduced. This per capita deductible was \$1.0430033 in 1970-71 prices.⁶⁷

Table II-5

PERCENTAGE INCREASE IN LOCAL GOVERNMENT TAX RATES NECESSARY TO RAISE LOCAL GOVERNMENT "BASE" EXPENDITURES UNDER ALTERNATIVE POLICIES, LOCAL GOVERNMENT AUTHORITIES (LGAs) IN THE BRISBANE RIVER VALLEY

Local Government Authority	1973-74		1974-75	
	Policy (a) (BLi/RLi)%	Policy (c) (DLi/RLi)%	Policy (a) (BLi/RLi)%	Policy (c) (DLi/RLi)%
	(1)	(2)	(3)	(4)
Boonah (S)	8.96075	15.56057	7.64526	13.75138
Brisbane (C)	0.13843	24.91694	0.10943	9.75595
Crows Nest (S)	13.44086	44.47581	11.90476	39.25619
Esk (S)	5.95238	19.72643	5.09165	16.15458
Gatton (S)	8.96057	13.35233	7.22543	18.87312
Ipswich (C)	1.26775	28.66628	0.75053	86.22384
Kilcoy (S)	22.32143	11.43571	19.37984	22.05891
Laidley (S)	9.72763	13.63852	11.62791	64.21256
Moreton (S)	4.89237	58.23072	3.92465	18.04239
Average	1.01921	25.62493	0.78862	19.81820

Notes: (1) BLi = Local government "base" expenditure

(2) RLi = Revenue of local government from rates and penalties

(3) DLi = Damage to local government assets

(4) S = Shire

(5) C = City

Sources: (1) BLi — *Authorization and Determination of Queensland Flood Relief Act 1974*

(2) RLi — Australian Bureau of Statistics, *Australian Municipal Information System Printout*, Data Edition No. 4, Australian Bureau of Statistics, Canberra, 1978

(3) DLi — Information supplied by Queensland Auditor-General's Department, Brisbane, 1978

⁶⁷ This matter is discussed at length in Section (4) of this chapter.

In Table II-6 we present the results of applying this per capita deductible to the nine local governments in the Brisbane River valley for the years 1970-71 to 1974-75, the 1970-71 per capita deductible being adjusted by the Consumer Price Index to maintain its value in real terms.

The figures in Table II-6 are quite different from those implied by the present policy, i.e. \$25,000 in current prices for all years for all local governments. Two quite striking differences occur for the cities of Brisbane and Ipswich. We can see the implications of such a policy change by considering the extent to which the nine local governments would have had to increase taxes so as to finance the hypothetical "base" expenditures of Table II-6. The percentage increases in taxes presented in Table II-7 are directly comparable to the data in columns (1) and (3) of Table II-5. These data can also be compared with the data of Table II-4.

Table II-6

INDEXED NATURAL DISASTER "BASE" EXPENDITURES FOR NINE LOCAL GOVERNMENT AUTHORITIES IN THE BRISBANE RIVER VALLEY, 1970-71 to 1974-75

\$

Local Government Authority	1970-71	1971-72	1972-73	1973-74	1974-75
Boonah (S)	5,701	6,126	6,261	7,071	8,097
Brisbane (C)	730,748	787,036	841,706	964,258	1,125,873
Crows Nest (S)	3,245	3,453	3,603	4,069	4,749
Esk (S)	5,819	6,127	6,379	7,138	8,253
Gatton (S)	8,447	9,079	9,687	11,141	13,159
Ipswich (C)	64,230	70,182	76,787	88,193	105,113
Kilcoy (S)	2,241	2,339	2,421	2,735	3,114
Laidley (S)	4,686	4,902	5,316	6,071	7,008
Moreton (S)	9,110	10,639	11,872	14,410	17,908

Note: The calculations assume that the per capita "base" expenditure is the average per capita natural disaster "base" expenditure for New South Wales and Victoria.

Sources: Table II-12; Australian Bureau of Statistics, *Australian Municipal Information System Printout*, Data Edition No. 4, Canberra, 1978; and Australian Bureau of Statistics, *Consumer Price Index - June Quarter 1976*, Australian Bureau of Statistics, Canberra, 1976, Table 1.

Table II-7

PERCENTAGE INCREASES IN LOCAL GOVERNMENT TAXES NECESSARY TO FUND HYPOTHETICAL "BASE" EXPENDITURES FOR NINE LGAs IN THE BRISBANE RIVER VALLEY, 1970-71 to 1974-75

Local Government Authority	1970-71	1971-72	1972-73	1973-74	1974-75
Boonah (S)	2.864824	2.810092	2.722174	2.534409	2.476147
Brisbane (C)	4.687888	4.489652	4.764284	5.339192	4.928313
Crows Nest (S)	2.496154	2.227742	2.324516	2.187634	2.261429
Esk (S)	1.914145	1.839940	1.822571	1.699524	1.680855
Gatton (S)	4.080676	4.071300	4.070168	3.993190	3.803179
Ipswich (C)	4.526427	4.243168	4.687851	4.472262	3.155599
Kilcoy (S)	2.409677	1.409036	2.660440	2.441964	2.413953
Laidley (S)	2.874847	2.753933	2.712245	2.362257	3.259535
Moreton (S)	3.463878	3.420900	3.792971	2.819961	2.811303

Sources: Table II-6; and Australian Bureau of Statistics, *Australian Municipal Information System Printout*, Data Edition No. 4, Australian Bureau of Statistics, Canberra, 1978.

Not surprisingly, a policy of applying an indexed per capita deductible has the effect of decreasing the extent to which small local authorities would need to increase taxes so as to finance "base" expenditure requirements from their own revenue sources. This would have happened for

all authorities in the Brisbane River valley with the exception of the cities of Brisbane and Ipswich. These two large authorities, on the other hand, would have been required to increase taxes more than the present policy requires of them.

It is our view that the rates of increase in taxes indicated in Table II-7 are not such as to pose a problem of vertical imbalance as it affects local governments. The initial assumption of this analysis of "base" expenditures for local governments was that the appropriate per capita deductible for local governments in 1970-71 was the mean of the per capita deductibles imposed on the Governments of New South Wales and Victoria in that year. One could make many assumptions as to the appropriate per capita deductible and repeat the analysis we have undertaken here. For example, if we were to assume that the appropriate per capita deductible in 1970-71 was \$2.0860066, i.e. twice the figure used in the calculations, then the increases in taxes and charges would be twice those indicated in Table II-7.

We conclude by pointing out that the calculations we have made for local governments have not taken into account horizontal imbalance between local governments. Our analysis has been based on a per capita deductible equal to the mean of the per capita deductible imposed on the Governments of New South Wales and Victoria at the inception of the deductible policy in 1970-71. Data limitations prevent us from making horizontally equalising adjustments to local government "base" expenditures.

(4) Horizontal Equalisation and "Base" Expenditures on Natural Disasters

We now consider whether the "base" expenditure requirements to be met by the States before any Australian Government assistance is payable contain any elements of horizontal equalisation.

The meaning of horizontal equalisation is based upon the definition of horizontal imbalance given by Lane.⁶⁸ The problem of horizontal imbalance in the Australian federation is partly reflected in the distribution of general revenue payments from the Australian Government to the States⁶⁹ and is also the subject matter of the deliberations of the Commonwealth Grants Commission.⁷⁰

In terms of Lane's definition, the Governments of New South Wales and Victoria⁷¹ could provide standards of public services equal to those provided by the other States by levying taxes and setting charges at substantially lower rates than the Governments of the other Australian States. Alternatively, the Governments of New South Wales and Victoria could provide substantially higher levels of public services than the other State Governments by levying taxes and charges at the same rates as in the other States. This problem is caused partly by differences in taxable capacities as between the Australian States.⁷²

The "base" expenditure requirement for a State Government in respect of natural disaster relief can be said to have a horizontal equalisation component if it serves to counteract the horizontal imbalance that exists between the Australian States. It is clear that the "base" expenditure is in the nature of a deductible, i.e. it is the level of expenditure that the State Government must incur before assistance is made available from the Australian Government. In terms of the theoretical analysis of Section (1) of this chapter, if the "base" expenditure requirement is to be horizontally equalising, then in per capita terms such requirement should be lower for the fiscally poorer or non-standard States than for New South Wales and Victoria.⁷³

In theory, the "base" expenditure requirement should only apply to a State's expenditure on its own assets. This is because, as we shall see later, the relief schemes for individuals appear

⁶⁸ See Section (1) above.

⁶⁹ Mathews and Jay, *op. cit.*, Chapter 10.

⁷⁰ Commonwealth Grants Commission, *Forty-third Report 1976 on Special Assistance for States*, A.G.P.S., Canberra, 1976, Chapter 3.

⁷¹ These two States are the "standard" States for the purpose of Grants Commission calculations.

⁷² *Ibid.*, Chapter 2. The problem is also caused by differences as between States in the costs of providing public services, a matter which is also taken into consideration by the Grants Commission.

⁷³ This assumes that the costs of items upon which the "base" expenditure is expended are the same in the two States, or that any cost differences that do exist are within the control of the States.

to be related to the distributional objective and hence should be the sole responsibility of the Australian Government. In fact, the "base" expenditure requirement includes a State's expenditure on all forms of natural disaster relief. Nevertheless we may still inquire as to whether such "base" expenditure requirements contain a horizontally equalising element.

A slight difficulty arises in the conceptual treatment of this "base" expenditure, in that the "base" is necessary *State* Government expenditure that is a precondition for the payment of an Australian Government specific purpose grant to the State Government under section 96 of the Commonwealth Constitution. This is an atypical situation in terms of horizontal equalisation arrangements, which are usually concerned with direct payments from the Australian Government to the Governments of the States. However, in this case the equalisation considerations relate to the "base" expenditures by the States and *not* the distribution of grants from the Australian Government to the Governments of the States.

In Table II-8 we present per capita "base" expenditures on natural disasters for the Australian States for the years 1970-71 to 1975-76. We have employed the mean State population data used by the Grants Commission in its calculations for the years 1971-72 to 1975-76. The population data for 1970-71 are 1971 census data. We have also calculated the simple average of per capita "base" expenditures for New South Wales and Victoria, the standard States for Grants Commission calculations.

Table II-8
PER CAPITA "BASE" EXPENDITURES ON NATURAL DISASTER RELIEF BY
STATES, 1970-71 to 1975-76

\$

Year	NSW	Vic	Q'd	SA	WA	Tas	Standard States Average
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
1970-71 ^a	1.0866778	0.9993287	1.0946518	1.2780021	1.4556620	1.5368341	1.0430033
1971-72 ^b	1.0760093	0.9902111	1.0804970	1.2672130	1.4332123	1.5290520	1.0331102
1972-73 ^c	1.0647813	0.9778995	1.0545186	1.2456002	1.4095095	1.5193720	1.0213404
1973-74 ^d	1.0558101	0.9667974	1.0284363	1.2388503	1.3827434	1.5045135	1.01130375
1974-75 ^e	1.0448229	0.9545628	1.0068466	1.2190167	1.3471037	1.4844137	0.9996929
1975-76 ^f	1.0209916	0.9372322	0.9540619	1.1937923	1.2948895	1.4767413	0.9791119

Sources: Base: Table II-1.

Population: ^a Commonwealth Bureau of Census and Statistics, *Population and Dwellings in Local Government Areas and Urban Centres*, Bulletin 6 Part 9, Commonwealth Bureau of Census and Statistics, Canberra, 1974, Table 1, p. 1.

^b Grants Commission, *Fortieth Report 1973*, A.G.P.S., Canberra, 1973, Table 1, p.115.

^c Grants Commission, *Forty-first Report 1974 on Special Assistance for States*, A.G.P.S., Canberra, 1974, Table 1, p.118.

^d Grants Commission, *Forty-second Report 1975 on Special Assistance for States*, A.G.P.S., Canberra, 1976, Table C-1, p.122.

^e Commonwealth Grants Commission, *Forty-third Report 1976 on Special Assistance for States*, A.G.P.S., Canberra, 1976, Table C-1, p.116.

^f Commonwealth Grants Commission, *Forty-fourth Report 1977 on Special Assistance for States*, A.G.P.S., Canberra, 1977, Table C-1, p.120.

Consider rows 1 and 2 of Table II-8, i.e. per capita "base" expenditures in the years 1970-71 and 1971-72. Recall that the population data in these two years are not *exactly* comparable. The per capita "base" expenditures for New South Wales and Victoria (the standard States) in the two years are lower than those for the other States, all of which have been claimant States before the Grants Commission at some time. Thus the differences in the sources of population data in the two years have not been significant in altering any conclusions. What this means is

that the "base" expenditures from State Government funds for natural disaster relief, set by the Australian Government, require a *higher* level of natural disaster relief services to be financed by the non-standard States before Australian Government grants are made available.

Thus the "base" expenditures on natural disaster relief have been set in such a way that they have a perverse effect in terms of horizontal equalisation; or, put otherwise, the "base" expenditures are horizontally "unequalising".⁷⁴

To analyse the horizontally unequalising aspects of the "base" expenditures for the various State Governments, it is of value to express the per capita "base" expenditures of the non-standard States as a proportion of the simple average of the per capita "base" expenditures of the standard States. These ratios are presented in Table II-9.

Table II-9

RATIO OF PER CAPITA "BASE" EXPENDITURES ON NATURAL DISASTER RELIEF IN THE NON-STANDARD STATES TO THE SIMPLE AVERAGE OF PER CAPITA "BASE" EXPENDITURES IN THE STANDARD STATES

Year	Q'ld	SA	WA	Tas
1970-71	1.0495190	1.2253097	1.3956447	1.4734700
1971-72	1.0458681	1.2266000	1.3872791	1.4800473
1972-73	1.0324850	1.2195740	1.3800585	1.4876255
1973-74	1.0169412	1.2250032	1.3672879	1.4876969
1974-75	1.0071559	1.2193912	1.3475175	1.4848697
1975-76	0.9744156	1.2192603	1.3225143	1.5082457

Source: Calculated from Table II-8.

If the value of the ratio is greater than unity, the "base" expenditure requirement can be said to have a horizontally unequalising effect, since such a value indicates that the standard of service for natural disaster relief required of the non-standard States before Australian Government assistance is payable is greater than that required of standard States. Now consider the value of unity for this ratio. What this means is that the standard of service to be provided by the Governments in the non-standard States from State Government funds is the same as that provided by the Governments of the standard States from their own funds. Such a situation is neutral with respect to horizontal balance because it implies equal per capita deductibles and, as we have argued in Section (1), such deductibles will have no effect on horizontal balance. Thus for there to be any element of horizontal equalisation in the "base" expenditure requirements the ratio must be less than unity.

There are several interesting features illustrated in Table II-9. First, the Tasmanian Government is worst off as a result of the horizontally unequalising effects of the "base" expenditure requirement. Its position has worsened through time, the ratio increasing from 1.47 in 1970-71 to 1.51 in 1975-76. Its position has also worsened relative to that of other non-standard States. Secondly, the position of the South Australian Government has shown a slight improvement through time. Thirdly, the Queensland Government is the least disadvantaged of the State Governments in terms of the horizontally unequalising effect of the "base" expenditure requirements for natural disaster relief. Fourthly, the positions of both Queensland and Western Australia have shown a noticeable improvement over time. Indeed the Queensland Government's position has improved to such an extent that the ratio fell below unity in 1975-76. In that year the "base" expenditure requirement thus had a horizontally equalising effect for the Queensland Government.

⁷⁴ Theoretically it would be possible to calculate the effects on horizontal imbalance between local governments of the "base" expenditure requirements for those local governments. However we lack sufficiently detailed empirical information to enable us to perform these calculations.

Thus far we have pointed out that the "base" expenditure requirements, which State Governments must finance from their own taxes in the manner specified, take no account of horizontal imbalance. More particularly we have found that the "base" expenditure requirements are in fact horizontally unequalising. We turn now to consider what the State Governments' "base" expenditures on natural disaster relief should have been so as to take account of the horizontal imbalance that exists in Australia. Let us begin by noting that the temporal data of Table II-8 are subject to two influences: first, the "base" expenditure requirements remained constant in money terms from 1970-71 until 1977-78 and thus were eroded in real terms by inflation; secondly, population growth in the States has had an effect on the per capita deductible implicit in the "base" expenditure requirements.

To determine what the "base" expenditure requirements should have been requires us to specify a benchmark. We will determine a benchmark by assuming that the average per capita expenditure by the standard States in 1970-71 was the appropriate standard of natural disaster expenditure, i.e. the appropriate deductible was \$1.0430033 per capita.⁷⁵ We also require a summary measure of differences between the State Governments in terms of fiscal capacity. We assume that inter-State differences in fiscal capacity can be measured by differences in per capita taxable incomes collected in the States by the Australian Government. In other words we use State per capita taxable income as a proxy for State fiscal capacity. In Table II-10 we have calculated taxable income per capita in the six Australian States for the period 1970-71 to 1974-75. Following Grants Commission methodology we assume that the standard can be calculated appropriately as the simple mean of the data for New South Wales and Victoria (see column (7)).

Table II-11 indicates the extent to which per capita taxable income in the non-standard States differs from the mean of per capita taxable income in the standard States. Given that we are employing State per capita taxable income as a proxy for State fiscal capacity, the ratios of Table II-11 indicate the extent to which the fiscal capacities of the Governments of Queensland, South Australia, Western Australia and Tasmania differ from the fiscal capacities of the Governments of the standard States of New South Wales and Victoria.

On the assumption that the horizontal imbalance in the Australian federation can be measured by differences in per capita taxable income, the ratios in Table II-11 can be described by a term such as "the fiscal capacity adjustment factors". By this we mean, in this context, the rate

Table II-10
TAXABLE INCOME PER CAPITA, BY STATES, 1970-71 to 1974-75

\$							
Year	NSW	Vic	Q'ld	SA	WA	Tas	Standard States
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
1970-71 ^a	1,385.67	1,388.11	1,126.21	1,210.92	1,295.55	1,143.75	1,386.89
1971-72 ^b	1,581.24	1,533.96	1,308.08	1,385.79	1,442.99	1,276.39	1,557.60
1972-73 ^c	1,576.47	1,639.79	1,423.18	1,494.16	1,473.13	1,365.94	1,608.13
1973-74 ^d	1,959.34	2,002.42	1,753.56	1,953.86	1,928.09	1,726.62	1,980.88
1974-75 ^e	2,431.40	2,486.15	2,199.13	2,395.63	2,398.68	2,269.74	2,458.78

Sources: Population: as for Table II-8.

Taxable Income: ^a Australian Treasury, *Income Tax Statistics*, Government Printer of Australia, Canberra, 1973, Table 2.

^b Australian Treasury, *Income Tax Statistics*, A.G.P.S., Canberra, 1974, Table 2.

^c Australian Treasury, *Income Tax Statistics*, A.G.P.S., Canberra, 1975, Table 2.

^d Australian Treasury, *Income Tax Statistics*, A.G.P.S., Canberra, 1976, Table 2.

^e Australian Treasury, *Income Tax Statistics*, A.G.P.S., Canberra, 1977, Table 2.

⁷⁵ We shall see later that this is not an important assumption for the procedures we will outline.

Table II-11

RATIO OF PER CAPITA TAXABLE INCOME IN THE NON-STANDARD STATES TO PER CAPITA TAXABLE INCOME IN THE STANDARD STATES, 1970-71 to 1974-75

Year	Q'ld	SA	WA	Tas
1970-71	0.81203989	0.87311900	0.93414042	0.82468689
1971-72	0.83980483	0.88969569	0.92641885	0.81945943
1972-73	0.88499064	0.92912886	0.91605156	0.84939650
1973-74	0.88524292	0.98635960	0.97335023	0.87164291
1974-75	0.89439885	0.97431653	0.97555698	0.92311634

Source: Table II-10.

by which the per capita standard of service on natural disaster relief in the standard States (\$1.0430033 in 1970-71), should be adjusted to determine the per capita standard of service on natural disaster relief in the non-standard States.⁷⁶ Note that the fiscal capacity adjustment factors for the non-standard States are not constant through time.

We pointed out previously that the per capita "base" expenditure on natural disaster relief had fallen through time because, among other things, no adjustment had been made to take account of inflation (see Table II-8). Given our assumption that the per capita deductible in the standard States in 1970-71 is the appropriate level of expenditure on natural disaster relief to be financed from State Government taxes, we can calculate what the per capita deductible in the standard States should have been in 1971-72 to 1974-75 to maintain value of the 1970-71 per capita deductible in real terms. Once we have determined the indexed per capita deductible for the standard States in this way, we can apply the fiscal capacity adjustment factors of Table II-11 to determine the horizontally equalising per capita deductibles in the non-standard States. The results of applying these two procedures are indicated in Table II-12.

Table II-12

INDEXED PER CAPITA "BASE" EXPENDITURES ON NATURAL DISASTER RELIEF IN STANDARD AND NON-STANDARD STATES INCORPORATING FISCAL CAPACITY ADJUSTMENTS, 1970-71 to 1974-75

\$

Year	NSW	Vic	Q'ld	SA	WA	Tas
1970-71	1.0430033	1.0430033	0.8469603	0.9106660	0.9743115	0.8601511
1971-72	1.1139931	1.1139931	0.9355368	0.9911149	1.0320242	0.9128722
1972-73	1.1813423	1.1813423	1.0454769	1.0976192	1.0821705	1.0034280
1973-74	1.3342433	1.3342433	1.1811294	1.3160437	1.2986860	1.1629837
1974-75	1.5572239	1.5572239	1.3927793	1.5172290	1.5191606	1.4374988

Sources: Table II-8, row 1 column (7); Table II-11; and Australian Bureau of Statistics, *Consumer Price Index - June Quarter 1976*, Australian Bureau of Statistics, Canberra, 1976, Table 1.

⁷⁶ Algebraically,

$$\begin{aligned}
 FCAF_i &= \left[\frac{TY_i}{Pop_i} \right] \div \left[\frac{TY_{SS}}{Pop_{SS}} \right] \\
 &= \left[\frac{TY_i}{TY_{SS}} \right] \times \left[\frac{Pop_i}{Pop_{SS}} \right]
 \end{aligned}$$

where FCAF_i is the fiscal capacity adjustment factor in the *i*th non-standard State

TY_i is taxable income in the *i*th non-standard State

TY_{SS} is taxable income in the standard States

Pop_i is population in the *i*th non-standard State

Pop_{SS} is population in the standard States.

It is of value to consider the ratios of per capita "base" expenditures on natural disaster relief in the non-standard States to per capita "base" expenditures in the standard States. The ratios one obtains from this calculation are, of course, those indicated in Table II-11. Such calculations are of the same nature as those undertaken to derive the data of Table II-9. In other words the data of Tables II-9 and II-11 are comparable in that both indicate the significance of "base" expenditure requirements for natural disaster relief by State Governments as those requirements affect horizontal imbalance in Australia. Recall that all data of Table II-9, with the exception of the figure for Queensland in 1975-76, exceeded unity. However, all data in Table II-11 are less than unity. If the "base" expenditure requirements of the non-standard States are to take account of horizontal imbalance, then the ratios of per capita "base" expenditure in the non-standard States to per capita "base" expenditure in the standard States should be less than unity. The extent to which such ratios are less than unity will depend on the degree and the method of measurement of the differences in fiscal capacity between the standard and the non-standard States.

We are now able to specify what the absolute "base" expenditures for the standard and non-standard States should have been in the period 1970-71 to 1974-75 so as to take account of both inflation and horizontal imbalance. All that is now necessary is to multiply the data of Table II-12 by the population of the States in the relevant years. The results are presented in Table II-13.

To summarise, there are three separate calculations necessary to obtain the data of Table II-13. First, there is an adjustment for changes in the general level of prices through time. Secondly, there is an adjustment, using the data of Table II-11, for differences in fiscal capacity as between the non-standard and the standard States.⁷⁷ Thirdly, there is an adjustment to take account of State population changes from year to year.

Table II-13

**INDEXED "BASE" EXPENDITURES ON NATURAL DISASTER RELIEF IN
STANDARD AND NON-STANDARD STATES INCORPORATING ANNUAL FISCAL
CAPACITY ADJUSTMENTS, 1970-71 to 1974-75**

\$						
Year	NSW	Vic	Q'd	SA	WA	Tas
1970-71	4,799,067	3,653,015	1,547,481	1,068,849	1,004,028	335,803
1971-72	5,176,503	3,937,520	1,731,679	1,173,183	1,080,117	358,211
1972-73	5,547,347	4,228,142	1,982,851	1,312,314	1,151,646	396,254
1973-74	6,318,576	4,830,228	2,296,942	1,593,466	1,408,815	463,798
1974-75	7,452,095	5,709,717	2,766,617	1,866,950	1,691,585	581,037

Sources: Table II-12 and "Population" sources as in Table II-8.

We pointed out previously that an assumption was necessary to specify a benchmark from which such calculations could be made. We assumed that the appropriate benchmark, i.e. the appropriate per capita level of expenditure on natural disaster relief to be funded from State Government taxes in the standard States, was \$1.0430033. We can see now that this is not a crucial assumption — if the deductible which is decided upon is different from \$1.0430033, then calculations of the same kind that we have undertaken here can be repeated to obtain data for the appropriate "base" expenditures on natural disasters for State Governments in subsequent years.

In undertaking this exercise we have been constrained by data available on taxable income by state. More specifically, there is a two-year time lag in the publication of income tax statistics in Australia. Such data are necessary to calculate the "fiscal capacity adjustment factors" of Table II-11.

⁷⁷ Naturally this fiscal capacity adjustment is not applied to the data of the standard States, New South Wales and Victoria, in specifying the appropriate "base" expenditures in Table II-13. Put otherwise, the fiscal capacity adjustment factor for New South Wales and Victoria is always unity.

This explains why 1974-75 is the last year for which we have calculated "base" expenditures in Table II-13. This time lag does not pose an insurmountable problem in making periodic adjustments to "base" expenditures. In Table II-14 we present the results of undertaking a less complete procedure than that for Table II-13, whereby instead of making annual fiscal capacity adjustments we have made only two fiscal capacity adjustments. More specifically, we have assumed that the fiscal capacity adjustment factors applicable in 1970-71 (row 1 of Table II-11) were also applicable in the following three years to 1973-74. We then applied the fiscal capacity adjustment factors for 1974-75 (row 5 of Table II-11) to the three years to 1976-77. For example, for Queensland in the year 1972-73 the indexed mean per capita "base" expenditure for New South Wales and Victoria was multiplied by the fiscal capacity adjustment factor for Queensland in 1970-71, the resulting figure then being multiplied by the Queensland population in 1972-73.⁷⁸

Table II-14

INDEXED "BASE" EXPENDITURES ON NATURAL DISASTER RELIEF IN STANDARD AND NON-STANDARD STATES INCORPORATING TWO DISCRETE FISCAL CAPACITY ADJUSTMENTS, 1970-71 to 1976-77

\$

Year	NSW	Vic	Q'ld	SA	WA	Tas
1970-71	4,770,384	3,631,737	1,535,370	1,065,661	988,049	335,717
1971-72	5,259,161	3,954,119	1,724,723	1,162,704	1,102,751	359,853
1972-73	5,637,247	4,257,676	1,882,333	1,247,542	1,192,816	383,850
1973-74	6,425,715	4,871,989	2,187,937	1,429,631	1,374,996	437,052
1974-75	7,597,228	5,771,227	2,888,624	1,901,998	1,728,500	578,593
1975-76	8,613,042	6,562,611	3,307,792	2,155,122	1,989,157	660,323
1976-77	9,802,738	7,469,087	3,764,688	2,452,803	2,263,913	751,532

Note: For procedures used in the compilation of this table, see text.

Sources: Table II-12 above; Australian Bureau of Statistics, *Summary of Vital and Population Statistics: September and December Quarters 1975*, Australian Bureau of Statistics, Canberra, 1976, Table 6; and Australian Bureau of Statistics, *Population and Vital Statistics: June Quarter 1977*, Australian Bureau of Statistics, Canberra, 1978, Table 2.

Before we comment on Table II-14, we should also note another small change in methodology. In this chapter we have, wherever possible, employed the population data used by the Grants Commission. However, a time lag of one year has led us to use, for purposes of Table II-14, the Australian Bureau of Statistics December Quarter intercensal estimates of the population of the States.

The small differences in "base" expenditures as between Tables II-13 and II-14 for New South Wales and Victoria for the years 1970-71 to 1974-75 are explained by the different population data employed. The difference between the figures for New South Wales in 1970-71 represents only 0.59 per cent of the "base" for New South Wales as calculated by invoking the population data used by the Grants Commission. All the differences between row 1 of Table II-13 and row 1 of Table II-14 may be explained in this way. However, the differences between row 2 of Table II-13 and row 2 of Table II-14 are explained not only by the different population data but also by the assumption that the appropriate fiscal capacity adjustments in 1971-72 are the same as those for 1970-71. And so on for all years other than 1974-75.

We do not suggest that the simplifying procedure we employed to obtain Table II-14 is the only procedure that could be adopted to adjust through time State Government "base" expenditures on natural disaster relief. For example, adjustments could be effected by calculating, say, a three-year moving average of the States' fiscal capacity adjustment factors. It is clear that the fiscal capacity adjustment factor is the variable which is most difficult to measure. The other variables, changes in the general level of prices and population in the States, pose no significant problems.

⁷⁸ From the formula given in n. 76, it can be seen that this procedure assumes that the relative per capita taxable incomes in the standard and non-standard States have remained unchanged.

In conclusion, we summarise the implications of the existing practice of making no temporal adjustment to the States' "base" expenditure requirements. First, the "base" expenditures were eroded by inflation as they remained constant in money terms from 1970-71 to 1977-78. Secondly, the horizontally unequalising aspect of those "base" expenditures has been continued and no account has been taken of changes in fiscal capacity through time. Thirdly, the per capita standard of service on natural disaster relief has been eroded by population growth. We have indicated in this chapter that appropriate adjustments can be made to take account of these various factors.

III THE QUEENSLAND 1974 FLOOD — DIMENSIONS OF THE DISASTER

In late 1973 and the early months of 1974 heavy rain fell throughout major parts of northern and eastern Australia. This rain was associated with a monsoonal trough which had quite remarkably strong and persistent monsoonal airflows. The monsoonal trough was well established by mid-December 1973 over northern Australia¹ and steadily moved further south than it had for many years. In January 1974 above average rains fell throughout Australia, with the exception of the southern part of Western Australia.²

January rainfall in Queensland reflected the general Australian pattern at this time. Rainfalls on Cape York Peninsula were slightly above normal; coastal and adjacent districts experienced rains up to three times normal, and inland districts experienced rain varying from four to six times normal. The most exceptional rain was in the Upper Western District (the Mt. Isa and Longreach region) where rainfall was eight times normal.³

Such monthly rainfall, some of which exceeded in certain places second, third and fourth highest annual recorded data, produced major and widespread flooding throughout the State.⁴ Record flooding occurred in many of the streams such as the Gilbert, Norman and Flinders Rivers that drain into the Gulf of Carpentaria, and in inland streams such as Cooper's and Eyre Creeks and the Georgina and Diamantina Rivers.⁵ Few streams in the State's drainage system did not experience flooding at this time.⁶ In south-east Queensland rainfall peaked in the four-day period 24-27 January 1974.⁷ A low pressure system in the monsoonal trough 600 kilometres east of Mackay deepened to become cyclone "Wanda" on 23 January. The cyclone crossed the Queensland coast on the evening of 24 January and continued in a south-westerly direction, disappearing as a surface meteorological feature north of Dalby on the Darling Downs on 25 January. "Wanda" was not a mature cyclone in that the low had not deepened sufficiently before it crossed the coast to produce destructive winds. Thus it was unlike cyclones "Althea" and "Tracy" which devastated Townsville and Darwin in December 1971 and December 1974 respectively.⁸ Having crossed the coast, "Wanda" weakened rapidly into a rain depression.

(1) Some Data on Damage

In January 1974 floodwaters entered the living areas of approximately 10,900 dwellings throughout Queensland.⁹ Approximately 85 per cent of these residences were flooded by water from the Brisbane River and a major tributary, the Bremer River.¹⁰ The Brisbane River flows through the city of Brisbane, the capital of Queensland. The major settlement on the Bremer River is the city of Ipswich. Floodwaters from the Brisbane River system also inundated approximately

¹ Typically the monsoonal trough, which is the source of the "wet season" in tropical Australia, is not well established until early or mid-January.

² See Department of Science, *Brisbane Floods January 1974: Report by Director of Meteorology*, A.G.P.S., Canberra, 1974, Figure 4. For a more technical account see A. J. Shields, "Synoptic Meteorology of Flood Period", in *January 1974 Floods Moreton Region: Proceedings of Symposium*, The Institution of Engineers, Australia, Queensland Division, Brisbane, 1974, pp. 7-32.

³ G. Heatherwick, "Flood Forecasting and Warnings", *ibid.*, pp. 56-8.

⁴ The first serious flooding in Queensland in 1973-74 occurred on 18 December 1973 in the Dawson River valley. See C. Barton, "Opening Address", *ibid.*, p.4.

⁵ See Heatherwick, *op. cit.*, Figure 2.

⁶ An exception was the Dumaresq River in the Texas region near the New South Wales border.

⁷ See Shields, *op. cit.*, Table 1.

⁸ Wind speeds associated with "Wanda" were between 70 and 80 km/h with squalls up to 100 km/h. On the other hand the Darwin anemometer was damaged and failed to function satisfactorily after recording a wind speed of 217 km/h shortly after midnight on 25 December 1974. This was the second highest reading in the recorded history of Australia. It has been suggested that "the actual peak winds were at least 240 km/h and could have reached 275 km/h". Darwin Reconstruction Commission, *First Annual Report 1975*, Government Printer of Australia, Canberra, 1976, p.8.

⁹ However, only 5,079 Queensland householders received grants from public funds for the restoration of their homes. See Government Flood Damaged Homes Committee, *Report, mimeo.*, Brisbane, 1975, Table 5, pp. 28-32. Why this was the case and the implications of the scheme that produced such a situation are considered in detail in Chapter V.

¹⁰ Information supplied by Queensland Flood Victims Committee, 1976.

1,600 industrial buildings and approximately 1,200 commercial buildings.¹¹ The extent of agricultural and pastoral losses is unknown.¹² Twenty-eight lives were lost in the State, fifteen in the Brisbane area.¹³

We do not know the extent of damage caused by floods in Queensland, let alone Australia, at this time.¹⁴ Floods in 1973-74 occurred not only in Queensland but also in New South Wales, Victoria and South Australia. However, we have available a partial flood damage study of the Brisbane River system, a study funded by the (then) Cities Commission and undertaken by the Snowy Mountains Engineering Corporation.¹⁵ The main purpose of this study was "to determine flood damage along the Brisbane River for floods of various magnitudes up to a maximum of 10m. (Australia Height Datum) at the Brisbane City Gauge".¹⁶ In undertaking this exercise the Snowy Mountains Engineering Corporation (S.M.E.C.) estimated flood damage in the Brisbane River system in January 1974.

We should note that in January 1974 the Brisbane River, unlike some other streams in the State, did not reach a record flood level. The Brisbane River flooded to a height of 5.45m. at the Brisbane City Gauge, the highest level the river has reached this century.¹⁷ However four previous floods since 1841 have exceeded the flood level of January 1974.¹⁸ A complication exists with such simple comparisons in that the Somerset Dam situated on the Stanley River, a tributary of the Brisbane River, has mitigated floods to varying degrees since its initial construction in 1943.¹⁹ It is also important to note that record flash flooding occurred in some of the creeks which flow into the Bremer River²⁰ as well as some creeks which flow into the Brisbane River from the northern side of the city.²¹

It is now convenient to consider why we described the S.M.E.C. study previously as a *partial* flood damage study. S.M.E.C. ignored flash flooding in tributary creeks and rivers in undertaking the stage-damage analysis of the Brisbane River. The S.M.E.C. study assumed "a level backwater from the Brisbane River up the Bremer River . . . and for each [metropolitan creek] tributary".²² In other words flood damage which was caused by floodwaters originating from runoff in the catchment of a tributary was ignored; however if that tributary experienced backwater flooding, i.e. flooding as a result of the height of water in the main stream, in this case the Brisbane River, then damage from such backwater flooding was included. Aitkin describes the S.M.E.C. procedure as follows: "Whenever a tributary river or creek entered the Brisbane River a level backwater was assumed to exist; that is, all points on the tributary upstream of the confluence were assumed to be flooded to the reduced level indicated by the flood profile at the confluence."²³

¹¹ Snowy Mountains Engineering Corporation, *Brisbane River Flood Investigations: Final Report*, Cities Commission, Canberra, 1975, Chapter 5.

¹² However it has been estimated that agricultural losses in the Brisbane River basin were \$1,600,000. *Ibid.*, p.57.

¹³ Queensland, *Parliamentary Debates*, 1974, Vol. 264, p.2628.

¹⁴ A by-product of these floods was a decision by the Australian Government to establish a Natural Disasters Organisation to absorb the existing Civil Defence Organisation and to "put new emphasis on the threat of floods, bushfires and other disasters" (Prime Minister's Press Statement No. 186 of 18 February 1974). For further details see A. Stretton, *Combating Disasters - Australia's New Concept*, Pacific Defence Reporter, October 1974.

¹⁵ Snowy Mountains Engineering Corporation, *op. cit.*

¹⁶ *Ibid.*, p.v.

¹⁷ A major source of confusion with respect to floods is that a flood measured at a particular geographical point, say the Brisbane City Gauge, indicates nothing with respect to flood heights at another geographical point, say 20 kilometres upstream from the first geographical point. For a discussion of this issue see G. Cossins, "Flood Envelopes and Frequencies for the Brisbane River", in *Hydrology Symposium 1976*, The Institution of Engineers, Australia, Sydney, 1976, pp. 50-5.

¹⁸ J. K. G. Ward, "Hydrology of the Floods", in *January 1974 Floods Moreton Region: Proceedings of Symposium*, The Institution of Engineers, Australia, Queensland Division, Brisbane, 1974.

¹⁹ For a discussion of this matter see J. K. G. Ward, *op. cit.* and T. J. Grigg, "An Evaluation of Brisbane Flood Mitigation Proposals", in *Hydrology Symposium 1977: The Hydrology of Northern Australia*, The Institution of Engineers, Australia, Canberra, 1977, pp.108-13.

²⁰ Heatherwick, *op. cit.*, p.58.

²¹ J. G. Cameron, "Flooding in Brisbane Metropolitan Creeks", in *January 1974 Floods Moreton Region: Proceedings of Symposium*, The Institution of Engineers, Australia, Queensland Division, Brisbane, 1974.

²² Snowy Mountains Engineering Corporation, *op. cit.*, p.15.

²³ A. P. Aitkin, "A Stage-Damage Curve for the Brisbane River", in *Hydrology Symposium 1976*, The Institution of Engineers, Australia, Sydney, 1976.

The problems associated with main stream and tributary flooding are complex and difficult to handle. The relative magnitudes of the two phenomena may vary in the same river system, depending on where the heaviest rain falls in the total catchment area. It is possible that an area may suffer from tributary flooding and that the level of water will subsequently fall. However, it is then possible for this same area to be flooded a second time as a result of a backwater flood in the tributary caused by a flood in the main stream. Such "double flooding"²⁴ occurred in many areas adjacent to the Brisbane River's tributaries in January 1974.

If one were to estimate damage from tributary flooding and then add this estimate to damage caused by main stream flooding, one would be double counting to the extent that damage included in the main stream flooding estimate (which occurred in a tributary of the main stream) had already been incurred, and counted, in the tributary flood damage estimate. S.M.E.C. handled this problem by assuming a "level backwater" flood. But in the circumstances of the January 1974 flood in the Brisbane River catchment, we can conclude that such a procedure underestimates flood damage. But we do not know the extent of the underestimation of damage that results from this assumption. That this assumption involves an underestimate has been recognised in the S.M.E.C. study. Having calculated damage estimates for a "level backwater" flood in January 1974 for the Brisbane River system, S.M.E.C. pointed out that actual damage "would have been much greater . . . because of the severe flooding on metropolitan tributaries in both Brisbane and Ipswich and the damage caused by the Bremer River in the City of Ipswich".²⁵

Before examining S.M.E.C.'s damage estimates, we now consider how damage was estimated. Damage was categorised by S.M.E.C. as tangible and intangible. Intangible damage, defined by such phenomena as increased marital stress, feelings of insecurity, depression, loss of health etc., was not measured. S.M.E.C. sub-categorised tangible damage as "direct damage" and "indirect damage". Direct damage was then defined as "those damages which result from the physical contact of property or structures with floodwater, including damage due to sediment, debris or any other floating object in the floodwater. The principal direct damages are those which occur to the structures or contents of private buildings (residences, factories, offices etc.) public buildings and public utilities".²⁶ Indirect damage, on the other hand, is that which occurs during or following the flood and includes "the value of lost business for flood affected commercial and industrial enterprises, the loss of revenue due to the disruption of public transport systems, removal of goods from flooded areas and their return after the flood, the construction or establishment of temporary facilities for families made homeless by the flood, the erection of temporary levees and the like".²⁷

The authors of the S.M.E.C. study consider that they may have underestimated what they were attempting to measure by up to 10 per cent:

"[F]lood damage studies tend to overlook certain direct damage through lack of knowledge of all possible sources of information. It was very apparent in this study that additional flood damage items kept appearing often very unexpectedly, during the progress of the study . . . The consideration of, or the inclusion of, the following items would have increased the damage estimates:

- an allowance for basement flooding especially in Brisbane
- an allowance for uninsured motor cars, boats, etc.
- damage in the Shire of Moreton
- buildings (especially commercial and industrial) which were not flooded but suffered because of their dependency on flooded buildings
- the extraction of data from aerial photos which were a few years old instead of up to date photos
- an allowance for flooding of the first floor (in addition to the ground floor) level."²⁸

²⁴ This is the term used in the S.M.E.C. study to describe the phenomenon we are discussing here. See Snowy Mountains Engineering Corporation, *op. cit.*, p.23.

²⁵ *Ibid.*, p.69.

²⁶ *Ibid.*, p.19.

²⁷ *Ibid.*

²⁸ *Ibid.*, p.69.

Flood damage (as defined) was estimated to be \$142 million for direct damage and \$178 million for tangible (direct and indirect) damage.²⁹ Recall that no estimate was made of intangible damage. Loss of life was included in intangible damage.

We now consider the S.M.E.C. study in more detail to gain some idea of how the flood damage was distributed between different categories of damage. Damage was categorised into eight components, namely Commercial, Industrial, Residential, Residential Clean-Up, Miscellaneous, Public Utilities, Motor Vehicles and Boats, and Ipswich Coal Mines.³⁰ These categories are more or less self-explanatory. However it is of value to comment on the "Miscellaneous" category. This category included damage to buildings such as churches, schools, sports pavilions, railway stations and hospitals. The estimate of damage for this category may be subject to a wide margin of error as "[very] little data were available on flood damage to buildings included in the "Miscellaneous" category".³¹

Damage recorded against the category "Ipswich Coal Mines" also deserves some comment. This is, of course, a particular industrial activity that could well have been included in the general "Industrial" category. Five mines were affected by the 1974 flood, only one of which was not abandoned.³²

In Table III-1 we aggregate the eight S.M.E.C. categories into four broader categories. Having regard to the items S.M.E.C. included in the "Miscellaneous" category, it is possible to combine damage in this category with damage in the "Public Utility" category. Also damage in the "Commercial", "Industrial" and "Ipswich Coal Mines" categories may be aggregated as all these categories relate to productive activity in the private sector.

Table III-1
CATEGORIES OF TANGIBLE DAMAGE FROM A 5.45m. "LEVEL BACKWATER"
FLOOD IN THE BRISBANE RIVER, 1974
\$ (1973-74 prices)

Category of Damage	Damage
Commercial and Industrial	114,400,000
Residential and Residential Clean-Up	35,900,000
Miscellaneous and Public Utilities	22,400,000
Motor Vehicles and Boats	5,600,000
Total	178,000,000

Note: Discrepancy between summation of data and total due to rounding.

Source: Calculated from Snowy Mountains Engineering Corporation, *Brisbane River Flood Investigations: Final Report*, Cities Commission, Canberra, 1975, Table 10.

We now consider to what extent damage caused by flooding in the Brisbane River in January 1974 was met by insurance.

(2) Insurance Claims

The State Insurance Commissioner has provided data on the claims arising from the weather conditions during January and February 1974.³³ The data were generated by questionnaires returned to the Commissioner by all insurance companies operating in Queensland. In all \$75,571,000 had been recorded as claims for the State of Queensland. A subsequent estimate in 1976 by Irish³⁴ indicates that pay-outs had risen slightly to approximately \$77 million. We indicate in Table III-2 the claims, as recorded by the Insurance Commissioner, paid to policy-holders in the Brisbane Metropolitan Area.

²⁹ *Ibid.*

³⁰ For a discussion of these categories see the S.M.E.C. study, pp.19-21 and *passim*.

³¹ *Ibid.*, p.51.

³² For a detailed account of how the rather complex issues associated with this problem were treated, see the S.M.E.C. study, pp.58-9 and 155-8.

³³ The data are reproduced in the S.M.E.C. study, Table 2.

³⁴ J. L. Irish, "Flood Insurance", in *Proceedings of the Symposium on Flood Plain Management*, The Institution of Engineers, Australia, Queensland Division, Brisbane, 1976, pp.35-8.

Table III-2

INSURANCE CLAIMS ARISING FROM WEATHER CONDITIONS DURING JANUARY AND FEBRUARY 1974 IN THE BRISBANE METROPOLITAN AREA

\$ (1973-74 prices)

Type of Policy	Claims
Fire and Householders	
Storm and Tempest and Rainwater Clauses	4,395,000
Flood Clause	44,789,000
Loss of Profit	
Storm and Tempest and Rainwater Clauses	133,000
Flood Clause	9,559,000
Motor Vehicle	3,155,000
Marine	4,387,000
Other	1,349,000
Total	67,776,000

Source: Calculated from Snowy Mountains Engineering Corporation, *Brisbane River Flood Investigations: Final Report*, Cities Commission, Canberra, 1975, Table 2.

It is our intention to aggregate the data of Table III-2 into the four categories of damage that we employed in Table III-1. However before we do so it is necessary to make some general comments on insurance in Australia.

Most residential dwellings in Australia are insured under a houseowner's policy, which typically includes a storm and tempest clause. In a survey of flooded dwellings in the Brisbane suburb of Jindalee, Swannell and Isaacs found that almost 95 per cent of the survey respondents had insurance cover on the structure of the dwelling.³⁵ An explanation of this quite high proportion of respondents having such insurance cover is that insurance on the structure of a dwelling is a prerequisite for obtaining a home mortgage from virtually all financial intermediaries in Australia. However such a policy does *not* cover flood damage. Insurance cover for flood damage can be obtained by an extension to the normal storm and tempest clause: cover for flood damage is not automatic with respect to the "comprehensive" houseowner's policies commonly held by owner-occupiers in Australia.

Insurance for the *contents* of a dwelling in Australia requires a policy separate from that for the dwelling's structure. However insurance for contents, under what is typically referred to as a householder's policy, is not necessary in order to obtain a home mortgage. Swannell and Isaacs found in their survey that 86 per cent of respondents held insurance cover on the contents of their dwellings.³⁶ As with insurance on the structure of the dwelling, flood cover for contents can be obtained by an extension to the storm and tempest clause but such cover is *not* automatic.³⁷

Prior to the January 1974 flood, approximately 1,800 householder and houseowner policies in the Brisbane area had flood insurance cover with the State Government Insurance Office (S.G.I.O.), the largest domestic insurer in Queensland and the most active insurance company in providing flood cover. This represented 3.6 per cent of all such S.G.I.O. policies in the Brisbane area at that time.³⁸

However we should note an exceptional case of flood insurance that exists in Australia. Homes purchased under the Defence Service Homes Scheme, so-called "war service" homes, must be insured under the Defence Service Homes Insurance Scheme.³⁹ This Scheme provides cover for flood risk in addition to cover for other risks that is typically offered in the houseowner

³⁵ P. Swannell and L. T. Isaacs, "An Assessment of the Consequences of the 1974 Flood in the Jindalee Area", Jindalee Area Flood Relief Action Committee, Brisbane, *mimeo.*, 1974, p. 14.

³⁶ *Ibid.*

³⁷ The insurance policies we have discussed so far are restricted to privately owned dwellings and contents.

³⁸ Irish, *op. cit.*, p. 35.

³⁹ However, applications under the Defence Service Homes Scheme are not normally granted on properties in known flood areas. Australian Treasury, *A Natural Disaster Insurance Scheme for Australia: A Discussion Paper*, A.G.P.S., Canberra, 1976, p. 11.

policies of the major insurance offices. This Scheme relates only to the structure of dwellings and does not extend to a dwelling's contents. There were approximately 28,000 dwellings in Queensland covered under this Scheme in 1974 and an amount of approximately \$2,000,000 was paid in respect of 1,200 weather related claims in early 1974.⁴⁰

In the light of these comments, we can interpret the claims of \$4,395,000 under Storm and Tempest and Rainwater clauses in Table III-2 as claims by owner-occupiers for flood damage to privately owned dwellings and contents. What is significant about this figure is the quite low extent to which flood damage to residences in Brisbane was covered by the societal pooling mechanism of insurance. From Table III-1, we know that flood damage to residences was approximately \$35,900,000.

Irish has written that "it would appear that less than 5 per cent of householders policies in Queensland have a flood risk extension".⁴¹ And we have already mentioned that only 3.6 per cent of S.G.I.O. policies in Brisbane have an extension for such cover. These figures can be contrasted with *sample* survey results for Brisbane and Ipswich which indicate that 10.3 per cent of sample respondents had flood cover of some kind.⁴² Another survey of one suburb, Jindalee, indicated that 8.6 per cent of the sample had flood cover.⁴³

There is little difficulty in understanding the difference between these figures. The Chamberlain *et al.* estimate was derived from questionnaires answered by a sample of householders in Brisbane and Ipswich who were flooded in 1974. Similarly the Swannell and Isaacs estimate was derived from a survey of householders in one particular suburb affected by the 1974 flood. It is to be expected that people subject to a high risk of flooding⁴⁴ will be more likely to have flood cover than the population in general.

Flood insurance is a quite different proposition for industrial and commercial assets. Typically, "keenly quoted" package deals are arranged for firms by extensions to fire or general insurance policies through a flood clause. Flood cover provided prior to January 1974 was typically extended at *nominal* rates, so as to retain the insurance business of valued clients. *Prior to January 1974 and until June 1976 there was no actuarial basis for the flood cover provided for commercial and industrial firms.*⁴⁵ This can be contrasted with the situation of insurance for residential assets, for which actuarially determined premiums are applied.⁴⁶ Thus claims under flood clauses of fire policies in Table III-2 relate to commercial and industrial claims. Claims of this kind amounting to almost \$45,000,000 have been met.

Claims under loss of profit policies clearly originate from commerce and industry, and there is reason to believe that claims under "Other" policies are also commercial and industrial claims. This is because some firms have obtained their flood cover, in their "keenly quoted" package deals, by extensions to policies other than fire policies.

Comprehensive insurance policies for motor vehicles include cover for flood risk. Irish, quoting the Queensland Insurance Commissioner, has written that weather related insurance claims were \$3,200,000 in the Brisbane area and \$600,000 in the remainder of Queensland. The former figure is somewhat higher than the S.M.E.C. damage estimate for motor vehicles. Thus we have evidence of an underestimate of a damage category in the S.M.E.C. study. Furthermore, the underestimation is more significant than might appear on the surface. This is the case for two reasons. First, the no-claim bonus system induces insurance policyholders not to claim for relatively small damage. Secondly, and more important in this case, many people do not comprehensively insure their vehicles. Rather, they take the option of insuring only for third party property damage. Under the S.M.E.C. procedure of estimating flood damage to motor vehicles, all flood damage to motor vehicles which were not comprehensively insured was excluded from the S.M.E.C. damage estimate for this category.

⁴⁰ For a general discussion of insurance in Australia, see Australian Treasury, *ibid.*, Chapter II.

⁴¹ Irish, *op. cit.*, p. 35.

⁴² Calculated from E. R. Chamberlain *et al.*, "Draft Queensland Flood Report: A Report to the Australian Department of Social Security", Brisbane, 1977, *mimeo.*, Chapter 4, Table 2.

⁴³ Swannell and Isaacs, *op. cit.*

⁴⁴ For an account of the complexities associated with interpreting the term "flood risk" see Grigg, *op. cit.*

⁴⁵ Irish, *op. cit.*, p. 37.

⁴⁶ For a commonly used premium schedule, see Irish, *ibid.*, Table 2.

As with motor vehicles, comprehensive insurance policies for boats and launches include flood cover.⁴⁷

We are now in a position whereby we can aggregate the insurance claims listed in Table III-2 using the categories we employed in Table III-1. This is done in column (2) of Table III-3. In column (1) of Table III-3 we reproduce the total damage data, as previously defined, and in columns (3) and (5) we have calculated the proportions of damage met and not met by insurance.

Before we comment on Table III-3, it is of value to recall the problems associated with measuring damage from natural disasters. We pointed out in Chapter I that there are numerous conceptual and empirical economic problems associated with estimating damage from natural disasters and that damage estimates are, by their very nature, approximate. In discussing the S.M.E.C. damage study of the Brisbane River flood of January 1974 in this chapter, we pointed to some of the specific problems in that study and argued, as did S.M.E.C., that damage has been underestimated. Also we found that actual insurance claims for damage to motor vehicles in fact exceeded S.M.E.C.'s estimate of damage for this category. This situation produces a strange inconsistency in Table III-3 to which we will refer later.

Insurance claims, in total, covered 38.1 per cent of damage estimated to have been incurred in the Brisbane River system in January 1974. That is to say, 61.9 per cent of damage was not met by insurance. However, these overall figures conceal noticeable variations as between damage categories. Almost 50 per cent of "Commercial and Industrial" damage was met by insurance whereas the proportion in the "Miscellaneous and Public Utilities" category was zero.⁴⁸ Only 12.2 per cent of damage to persons' residences was met by insurance so that flood victims, in the absence of other assistance, would have had to bear almost 88 per cent of residential damage themselves. But because of the underestimate of damage to motor vehicles, it appears from Table III-3 that 134.6 per cent of damage to "Motor Vehicles and Boats" was met by insurance. This result is a manifestation of the underestimation of damage in this category and we have interpreted it to mean that zero per cent of damage in this category was not met by insurance. However, we have pointed out that this is unlikely to have been the case as damage to motor vehicles not comprehensively insured would, by definition, have been borne by the owners.

Table III-3

TOTAL DAMAGE, ABSOLUTE DAMAGE AND PROPORTION OF TOTAL DAMAGE MET AND NOT MET BY INSURANCE CLAIMS, BRISBANE RIVER FLOOD, JANUARY 1974

Category of Damage	Total Damage \$ (1)	Damage Met by Insurance		Damage not Met by Insurance	
		\$ (2)	% (3)	\$ (4)	% (5)
Commercial and Industrial	114,400,000	55,839,000	48.8	58,561,000	51.2
Residential and Residential Clean-Up	35,900,000	4,395,000	12.2	31,505,000	87.8
Miscellaneous and Public Utilities	22,400,000	0	0.0	22,400,000	100.0
Motor Vehicles and Boats	5,600,000	7,542,000	134.6	0	0.0
Total	178,000,000	67,776,000	38.1	110,224,000	61.9

Source: Tables III-1 and III-2.

We conclude this section by making two observations. First, had the nature of cyclone "Wanda" been such that damage was caused by destructive winds, then the insurance mechanism would have met a much higher proportion of damage under the storm and tempest clauses of fire, houseowner's and householder's policies. By chance, the damage caused by cyclone "Wanda"

⁴⁷ Snowy Mountains Engineering Corporation, *op. cit.*, p. 58.

⁴⁸ This is not an unexpected result, as the items in this category are predominantly government assets and governments engage in self-insurance.

took the form of flood damage and many people and firms found themselves uninsured for such damage. Secondly, given this state of affairs, Table III-3 indicates the damage which would have had to be borne by flood victims if no further assistance from other members of society was forthcoming. Of particular interest is the economic position of those people who were faced with bearing almost 89 per cent of total residential damage themselves.

We turn now to consider in detail the reaction of governments to this particular natural disaster.

(3) Redistribution by Government

When flooding in Queensland became extremely severe in January 1974, the Australian Government considered it to be "a major disaster" and some provisions of Australian Government assistance were invoked.⁴⁹ As has been pointed out in Chapter II, such Australian Government assistance takes the form of specific purpose payments to the State Government. We have noted before that Queensland was not the only State in Australia affected by adverse weather conditions at this time. In fact the Australian Government provided assistance not only to the Queensland Government but also to the Governments of New South Wales, Victoria and South Australia for flood damage in 1973-74. However approximately 51 per cent of all Australian Government specific purpose payments to the State Governments for all natural disasters in the period 1973-74 to 1976-77 was paid to the Queensland Government for "flood, storm and cyclone".⁵⁰

In passing the *Queensland Flood Relief Act 1974*, the Commonwealth Parliament appropriated \$66 million for payments, including advances, under the Act. Section 6 of this Act simply states: "Payment of an amount (including an advance) to the State under this Act is subject to such conditions, if any, as the Treasurer determines."⁵¹ In consultation with the Queensland Government, the Commonwealth Treasurer determined the conditions which would apply and such conditions have been recorded in the *Authorization and Determination of the Queensland Flood Relief Act 1974*.

The *Authorization and Determination* specifies the following categories of assistance:

- (a) grants for personal distress and hardship;
- (b) grants for the restoration of state and local government assets;
- (c) grants and loans for the repair and rebuilding of houses;⁵²
- (d) loans for small business enterprises;
- (e) grants for the restoration of assets of educational institutions; and
- (f) loans for sporting clubs and associations.

These and other categories (for example, rail and road freight subsidies, assistance to surf life saving clubs) are employed by the Australian Treasury to record expenditures by the Australian Government on natural disaster relief.⁵³ However, the data published there are inadequate for our purpose of determining and analysing government expenditures for a particular disaster, namely the floods in Queensland in 1973-74.⁵⁴ This is because the published data for Queensland refer not only to the 1973-74 floods but also to cyclone "Althea" (1971) in Townsville, the Brisbane tornado (1973) and the floods of 1976-77.

In Table III-4 we present data on payments incurred by the Queensland Government as a result of the 1973-74 floods. Although the data in this table are different from those presented by

⁴⁹ The form of Australian Government assistance may vary from case to case depending on the nature of the particular disaster (drought, flood etc.). For further details see Australian Treasury, *Payments to or for the States and Local Government Authorities 1977-78*, A.G.P.S., Canberra, 1977, pp. 108-9.

⁵⁰ We have calculated that in the period 1973-74 to 1976-77 payments to Queensland for water-related relief by the Commonwealth were approximately 53 per cent of all Commonwealth payments to all States for "flood, storm and cyclone". In turn payments for "flood, storm and cyclone" to all States during the period 1973-74 to 1976-77 represented 95 per cent of all Commonwealth payments to the States for all types of natural disaster. *Ibid.*, Table 118.

⁵¹ This is exactly the same wording as was employed in the *Tasmania Grant (Fire Relief) Act 1967*.

⁵² We have ascertained that no loan funds authorised under the *Queensland Flood Relief Act 1974* were employed for the repair or rebuilding of flood damaged homes. Recourse was made, if necessary, to loan funds administered by the Queensland Housing Commission. See Chapter V, n.20.

⁵³ See Australian Treasury, *Payments to or for the States and Local Government Authorities 1977-78*, *op. cit.*, Table 119.

⁵⁴ The last payments under the *Queensland Flood Relief Act 1974* were made in 1976-77.

the Australian Treasury,⁵⁵ we have been able to reconcile the two sets of data by taking into account payments relating to cyclone "Althea", the Brisbane tornado and the 1976-77 floods.

We know that, in addition to the payments indicated in Table III-4, further payments of \$99,000 were incurred in 1976-77. Thus total payments by the Queensland Government as a result of the 1973-74 floods were \$63,245,425. One point we can make is that clearly not all the funds appropriated under the Australian Parliament's *Queensland Flood Relief Act 1974* were employed.

Table III-4

PAYMENTS BY THE QUEENSLAND GOVERNMENT FOLLOWING THE 1973-74 FLOODS, 1973-74 to 1975-76

\$

Category of Assistance	1973-74	1974-75	1975-76
Personal Distress and Hardship ^a	5,277,926	121,579	2,053
Housing Repair and Rebuilding ^a	5,120,462	6,820,907	—
Restoration of State Government Assets ^a	7,313,806	7,405,450	489,262
Restoration of Local and Semi-Government Assets ^a	9,407,073	12,695,733	2,711,408
Assistance to Tertiary Education Institutions ^b	106,000	524,000	102,000
Loans to Primary Producers ^a	161,084	661,881	—
Loans to Small Businesses ^a	3,494,932	614,885	—
Loans to Sporting Bodies ^a	—	42,901	73,084
Total	30,881,283	28,887,335	3,377,807

Note: Data in this table include the Queensland Government's "base" expenditure, but exclude "base" expenditures by local governments.

Sources: ^a Information supplied by Queensland Treasury Department, 1977.

^b Australian Treasury, *Payments to or for the States and Local Government Authorities 1977-78*, A.G.P.S., Canberra, 1977, Table 119.

Table III-5

PAYMENTS INCURRED BY THE QUEENSLAND GOVERNMENT FOLLOWING THE 1973-74 FLOODS, CONSTANT PRICES, 1973-74 to 1975-76

\$ (1973-74 prices)

Category of Assistance	1973-74	1974-75	1975-76
Personal Distress and Hardship	5,277,926	105,023	1,560
Housing Repair and Rebuilding	5,120,462	5,865,980	—
Restoration of State Government Assets	7,313,806	6,368,687	371,839
Restoration of Local and Semi-Government Assets	9,407,073	10,918,330	2,060,670
Assistance to Tertiary Education Institutions	106,000	450,642	77,520
Loans to Primary Producers	161,084	569,218	—
Loans to Small Businesses	3,494,932	528,801	—
Loans to Sporting Bodies	—	36,895	55,541
Total	30,881,283	24,843,576	2,567,130

Source: Table III-4; and Australian Bureau of Statistics, Consumer Price Index, Brisbane, All Groups.

⁵⁵ Australian Treasury, *Payments to or for the States and Local Government Authorities 1977-78*, op. cit., Tables 67 and 118.

The data of Table III-4 tell us very little. One of the reasons for this is that the figures are in current prices. If we wish to obtain an estimate of the extent of damage restoration undertaken with government assistance we must convert the figures to constant price data. Table III-5 presents such data in constant (March Quarter 1973-74) prices using the Consumer Price Index, Brisbane, All Groups.

From Table III-5 combined with the 1973-74 constant price equivalent of the \$99,000 expenditure incurred in 1976-77, we can assert that the total Queensland Government payments as a result of the 1973-74 floods were \$58,357,751 in 1973-74 prices.

So far we have recorded payments without distinguishing between economic categories of payments. Such data may be useful for some purposes but they do not help us to determine what proportion of natural disaster damage was borne by government. To answer this question, we must recognise that the payments in Tables III-4 and III-5 comprise three distinct economic categories. First, personal distress and hardship grants are of a recurrent nature. Secondly, grants for housing repair and rebuilding, restoration of State government assets, restoration of local and semi-government assets, and assistance to tertiary education institutions are of a capital nature. The last three categories, covering assistance to primary producers, small businesses and sporting bodies, although of a capital nature are in the form of loans.⁵⁶

Assistance in the form of loans is *not* measured by the value of those loans. Because a loan is repayable it provides assistance to the extent to which it is made available at a concessional rate of interest, i.e. an interest rate below prevailing "market" rates at the time.⁵⁷ The loans that were made available following the 1974 floods were at concessional rates for various periods of time. In Table III-6 we summarise the conditions of the loans as specified in the *Authorization and Determination of the Queensland Flood Relief Act 1974*.

The administration of the concessional loans was undertaken by existing Queensland Government instrumentalities such as the State Agricultural Bank and the Department of Commercial and Industrial Development. The eligibility conditions varied for the three types of applicant, but there were two common conditions: attempts to secure funds through normal sources of finance had to have been exhausted; and the applicant (or applicant body) must have had a "reasonable" chance of recovery. However eligibility conditions then differed as between the applicant categories. We note particularly the differences between primary producers and small businesses.

Concessional loans to small businesses were restricted to sole owners, partnerships and private companies; public companies were specifically excluded. However no such restriction was placed on concessional loans to primary producers. Small businesses were required to demonstrate that they were unable to effect repairs "from their own resources" whereas no such condition was required of primary producers. In determining the size of the loan, insurance recoveries by small

Table III-6
SOME CONDITIONS OF CONCESSIONAL LOANS MADE FOLLOWING THE 1974 QUEENSLAND FLOODS

	Primary Producers	Small Businesses	Sporting Bodies
Rate of Interest	3-6%	5%	5%
Period of Loan	8 years ^a	3-5 years	7 years
Maximum Loan	\$40,000	\$25,000	\$10,000

Note: a The *Authorization and Determination* does not specify the period of loans for primary producers. Thus we have used the time period for primary producers stated in the Schedule for all loan repayments (including those of primary producers) to be made by the Queensland Government to the Australian Government.

Source: *Authorization and Determination*.

⁵⁶ For a general discussion of classification of items in the budget of the Australian Government see Australian Treasury, *Payments to or for the States and Local Government Authorities 1975-76*, A.G.P.S., Canberra, 1975.

⁵⁷ Interest rates in Australia are subject to influence by the Reserve Bank of Australia. Thus Australian rates of interest should not necessarily be regarded as market rates.

businesses were to be taken into consideration; no such condition was specified in the case of primary producers. Concessional loans to small businesses were not to exceed the net loss of the firm during the flood, but no such condition was specified for primary producers.

Although the conditions of these concessional loans varied, from the information that is available we are able to calculate the grant equivalent, or the present value of the income assistance from loans granted at concessional rates of interest. To undertake this exercise we need to make only one assumption as to the prevailing market rate of interest at the time.⁵⁸ There is, of course, a range of interest rates in various money markets at any time.⁵⁹ From the data available on interest rates of Australian trading banks it is not unreasonable to assume that the market rate of interest was of the order of 10 per cent.⁶⁰ In fact this is a conservative assumption, in that applicants for the concessional interest rate loans we are considering here had to have been unsuccessful in obtaining loan funds from the traditional financial intermediaries, or to have exhausted such avenues of finance and still to have required more loan funds to re-establish themselves following the floods. It is quite conceivable that such applicants *may* have been able to obtain the necessary loan funds at somewhat higher prices from the traditional financial intermediaries, say 13-15 per cent. It is for this reason that we consider that our assumption of 10 per cent as the prevailing market rate of interest is conservative.

However, assistance to natural disaster victims in the form of loans takes a second form, irrespective of whether or not the loans are granted at concessional rates of interest. During periods of inflation, if account is not taken of the changes in the value of the currency, then there will be a redistribution of income from creditors to debtors during the period of the loan. Such a situation can be avoided by indexing that part of the periodic payments associated with the loan which relates to repayment of the loan principal.⁶¹ No such indexing of loan repayments has taken place and we have calculated the assistance given to loan recipients in the form of this purchasing power gain.

To undertake this exercise, we have to estimate what the loan principal repayments should have been so as to be distributionally neutral between debtors and creditors throughout the periods of the various loans. We have used the Consumer Price Index, All Groups, Brisbane, for this exercise, using the March Quarter 1974 as the base.⁶² We have had to make assumptions about the rate of inflation for the years 1978-79 to 1981-82. We have made what we consider to be conservative assumptions on this matter by taking annual values for the rate of inflation of 6, 6, 4, 4 and 4 per cent respectively for the five years to 1982-83. If the rate of inflation in the years to 1982-83 is higher than we have assumed, our calculations will underestimate the extent of the purchasing power gain from non-indexed loans. On the other hand, if the inflation rate for those years turns out to be less than we have assumed here, then our calculations will overestimate the purchasing power gain.

To facilitate comparisons with assistance in the form of grants, we have undertaken all calculations of the gains from concessional interest rates and purchasing power gains from non-indexed loans in constant 1973-74 prices using the March Quarter as base. The economic assistance from the loans accrues through time and to undertake the comparisons we must discount the time stream of assistance from the loans to a point of time. We have discounted all time stream data to 1973-74 at a 10 per cent rate of discount.⁶³

⁵⁸ More specifically, we assume a particular value for the prevailing market rate at the time and assume that this rate remains constant for the period of the loan.

⁵⁹ For an indication of the ranges that existed from June 1973 to June 1977 for term loans, farm development loans and other advances of the major trading banks in Australia, see Reserve Bank of Australia, *Statistical Bulletin*, Reserve Bank of Australia, September 1977, pp.85-6.

⁶⁰ *Ibid.*

⁶¹ The adjustment we are considering here is not exactly the same as that advocated by M. Friedman in *Monetary Correction: A Proposal For Escalator Clauses to Reduce the Cost of Ending Inflation*, The Institute of Economic Affairs, London, 1974, pp.21-30. This is because Friedman's objective is to calculate what annual repayments of loans should be so as to have debtors paying a real rate of interest. Our objective is to calculate simply the purchasing power gain obtained by the debtor. Hence our calculations relate only to that part of the yearly loan repayment which constitutes repayment of principal. Friedman's concern leads him to make his calculations with respect to the total yearly repayment, i.e. principal and interest.

⁶² Australian Bureau of Statistics, *Consumer Price Index - June Quarter 1976*, Australian Bureau of Statistics, Canberra, Table 1; and Australian Bureau of Statistics, *Consumer Price Index - March Quarter 1978*, Australian Bureau of Statistics, Canberra, Table 2.

⁶³ Under the procedures we have adopted here this is a "real" rate of discount.

Table III-7
TIME STREAM AND 1973-74 PRESENT VALUES OF GRANT EQUIVALENTS OF LOANS
AT CONCESSIONAL RATES OF INTEREST AND CAPITAL GAINS OF LOANS
 \$ (1973-74 prices)

	Primary Producers ^a			Small Businesses ^b			Sporting Bodies ^c			All Loans		
	Gain From Concessional Interest Rate (1)	Purchasing Power Gain (2)	Total Gain (3)	Gain From Concessional Interest Rate (4)	Purchasing Power Gain (5)	Total Gain (6)	Gain From Concessional Interest Rate (7)	Purchasing Power Gain (8)	Total Gain (9)	Gain From Concessional Interest Rate (10)	Purchasing Power Gain (11)	Total Gain (12)
1974-75	5,414	2,369	7,783	98,652	102,399	201,051	—	—	—	104,066	104,786	208,852
1975-76	24,360	22,122	46,482	108,475	194,987	303,453	1,062	631	1,693	133,897	217,731	351,628
1976-77	21,155	31,225	52,380	94,202	277,844	372,046	2,672	3,097	5,769	118,029	312,166	430,195
1977-78	19,873	37,398	57,271	88,493	335,985	424,478	2,510	4,741	7,251	110,876	378,124	489,000
1978-79	18,590	42,563	61,153	82,783	46,734	129,517	2,348	6,372	8,720	103,721	95,669	199,390
1979-80	17,629	47,841	65,470	—	—	—	2,227	7,299	9,526	35,266	55,140	90,406
1980-81	16,988	51,447	68,435	—	—	—	2,146	8,072	10,218	19,134	59,519	78,653
1981-82	16,347	56,494	72,841	—	—	—	2,065	9,184	11,249	18,412	65,678	84,090
1982-83	12,364	48,552	60,916	—	—	—	1,272	6,179	7,451	13,636	54,731	68,367
1973-74 Present Value	97,603	196,219	293,822	370,650	721,478	1,092,128	9,919	25,210	35,129	478,172	942,907	1,421,079

Notes: ^a Assuming loans for 8 years at a rate of interest of 4%

^b Assuming loans for 4 years at a rate of interest of 5%

^c Assuming loans for 7 years at a rate of interest of 5%

Source: Table III-5.

Columns (1), (4) and (7) of Table III-7 present the time streams, and the last row the 1973-74 present values, of the gains from loans at concessional interest rates for primary producers, small businesses and sporting bodies respectively. Column (10) indicates all gains from concessional rates of interest for these three categories of loans. Columns (2), (5) and (8) indicate the time streams and 1973-74 present values of the purchasing power gain from non-indexed loans for primary producers, small businesses and sporting bodies respectively as a result of the inflation that has taken place from 1973-74 to 1977-78 (March Quarter 1974 as base) and the inflation that we have assumed will occur during the period 1978-79 to 1982-83. Column (11) indicates the total economic assistance from the purchasing power gain. Columns (3), (6) and (9) indicate the total gains i.e. concessional interest rate plus purchasing power gain, for primary producers, small businesses and sporting bodies respectively. Column (12) indicates total economic assistance from all non-indexed loans (as defined) at concessional rates of interest.

It is the last row of Table III-7 that is of most interest to us. It indicates, for example, that instead of giving concessional loans to primary producers as indicated in Table III-4, the Government could have given those same primary producers grants worth \$293,822 in 1973-74 and those primary producers would have been no worse off.⁶⁴ Similar statements can be made concerning the grant equivalents of concessional loans for small businesses (\$1,092,128) and sporting bodies (\$35,129). The total grant equivalent of all concessional loans was \$1,421,079.

We can now express the data of Table III-5 as grants and grant equivalents. Table III-8 presents the relevant data.

Table III-8
GRANTS AND GRANT EQUIVALENTS INCURRED BY THE QUEENSLAND
GOVERNMENT FOLLOWING THE 1973-74 FLOODS, CONSTANT PRICES, 1973-74 to
1976-77

\$ (1973-74 prices)

Category of Assistance	Grants or Grant Equivalents
Personal Distress and Hardship	5,384,509
Housing Repair and Rebuilding	10,986,442
Restoration of State Government Assets	14,120,095
Restoration of Local and Semi-Government Assets	22,386,073
Assistance to Tertiary Education Institutions	634,162
Assistance to Primary Producers	293,822
Assistance to Small Businesses	1,092,128
Assistance to Sporting Bodies	35,129
Total	54,932,360

Source: Tables III-5 and III-7.

We are now in a position to answer an interesting question: what proportion of total government assistance was financed by each of the three levels of government in Australia?

The data of Table III-8, although necessary in answering this question, are not sufficient. As we have pointed out in Chapter II, the Commonwealth policy on natural disasters which has operated from 1970-71 requires that local governments meet 25 per cent of disaster relief up to damage of \$100,000 from their own funds, and if damage exceeds \$100,000 the local government "base" expenditure remains at \$25,000. Table III-8 does not include the "base" expenditure of local governments in Queensland which were affected by flooding in 1973-74. At least 28 of the 132 local governments in Queensland experienced some damage to their assets during 1973-74.⁶⁵

⁶⁴ This is to assume that the primary producers do not default on the loans and that the Government does not invoke a "forgiveness" clause for the defaulters. For an account of such complexities, see D. C. Dacy and H. Kunreuther, *The Economics of Natural Disasters*, The Free Press, New York, 1969, Chapter 2.

⁶⁵ This is a minimum estimate, as there were 28 local governments which received assistance following the floods. There may have been other local governments which experienced some minor damage to assets but which did not seek assistance from the Australian Government.

From the information available we have calculated that "base" expenditures by local governments following the 1973-74 floods in Queensland amounted to \$1,298,545 in 1973-74 prices. As noted above, this amount does not appear in Table III-8.

The data of Table III-8 also do not indicate the full extent of direct Australian Government expenditure. For example, excluded from Table III-8 are the costs of emergency services provided by the Defence Services⁶⁶ and the donations of \$600,000 by the Australian Government to official disaster relief appeals.⁶⁷ Such contributions were made directly to the appeal funds and did not take the form of payments to the State Government.⁶⁸ Also the costs of restoration of Australian Government assets are not indicated in Table III-8. The only figure that we know of is that for \$2,360,000 damage to telephone communications in the Brisbane River valley.⁶⁹

The expenditures referred to in the previous paragraph were not recorded as payments to the State. On the other hand, although assistance to tertiary education institutions was administered by the Australian Universities Commission and by the Australian Commission on Advanced Education, the funds were paid through State Treasury accounts.⁷⁰

The Australian Department of Social Security incurred additional costs of approximately \$42,000 until December 1974 in the form of welfare services expenditure involving the services of social workers to Queensland flood victims.⁷¹ This figure does not include the salaries of social workers transferred or seconded from other departments or State offices to the Queensland Office of the Department of Social Security. This Department also provided a grant of \$90,000 to assist the activities of the Queensland Disaster Welfare Committee.⁷² The Minister for Social Security at the time (Mr W. G. Hayden) extended the provisions of 'special benefit' to persons who lost their source of wage income as a result of the floods.

Special benefit is paid by the Department of Social Security to several categories of people: migrants in government accommodation centres awaiting their first employment in Australia; unmarried mothers for twelve weeks before confinement and six weeks after it; and persons caring for an invalid parent or other near relative on a full-time basis. Following a natural disaster the Minister for Social Security has the power to extend the provisions of special benefit to employees of firms that cease production as a result of the natural disaster. From data made available to us by the Queensland Office of the Department of Social Security, we have calculated that an amount of approximately \$233,000 was paid to Queensland flood victims, including \$163,000 to claimants in Brisbane and Ipswich, under the provisions of special benefit.⁷³

The expenditures mentioned above were not the only forms of assistance provided by the Australian, State or local governments. Government departments, for example the Australian De-

⁶⁶ We have been able to determine only one cost item of the Department of Defence. In flying more than 4,000 sorties in support of flood relief operations in Queensland and northern New South Wales, the aircraft operating costs of the Royal Australian Air Force exceeded \$1 million. Quoted by Stretton, *op. cit.*

⁶⁷ The Australian Government contributed \$350,000 to the State Government initiated Queensland Flood Victims' Fund and \$250,000 to the Brisbane Lord Mayor's Appeal Fund. It was understood that of the \$350,000 donated to the Queensland Flood Victims' Committee, \$100,000 was to be applied in the Ipswich area and the remainder (\$250,000) was to be applied to other areas outside Brisbane and Ipswich. Joint Press Statement issued by the Australian and Queensland Governments, no date.

⁶⁸ Similarly, the donation of \$500,000 by the Queensland Government to the Queensland Flood Victims' Fund, the Chairman of which was Sir Thomas Hiley, is not recorded in Table III-8.

⁶⁹ Snowy Mountains Engineering Corporation, *op. cit.*, Table 7.

⁷⁰ Flood-damaged assets of the following institutions were included under this heading: the University of Queensland, residential colleges at the University of Queensland, the Kedron Park Teachers College, the Queensland Agricultural College and the Queensland Institute of Technology.

⁷¹ Information supplied by the Central Office of the Department of Social Security, Canberra, 1974.

⁷² For a detailed account of the origins and activities of this organisation, see Chamberlain *et al.*, *op. cit.*, pp. 151-5 and *passim*.

⁷³ The weekly numbers of persons receiving special benefit because of the flood give an indication of the temporal nature of disruption to employment. In the week ending 2 February 1974, 2,444 employees were admitted to special benefits under the natural disaster eligibility category. Within one week (i.e. by 9 February 1974) there were only 1,508 flood claimants. By the end of the next week, the number of claimants had fallen to 559. By the week ending 9 March 1974, i.e. approximately six weeks after the major flooding had occurred, there were only 77 employees who remained out of work because flooding had disrupted production. We are left with an impression of relatively rapid resumption of economic activity. A similar pattern has been documented for flood victims in terms of resumption of residence. It has been found that over three-quarters of respondents in a sample of Brisbane and Ipswich flood victims had returned to live in their homes within four weeks of the flood, and almost half had returned within two weeks. *Ibid.*, p. 45.

partment of Health, the Queensland Police Force and the Electricity Department of the Brisbane City Council provided many and varied types of assistance to individuals.⁷⁴ By way of example, the administration of capital grants for the restoration and repair of flood damaged houses under the *Queensland Flood Relief Act 1974* was undertaken by the "Government Flood Damaged Homes Committee". The principal officers of this Committee were all senior members of the Queensland public service. Subsequently the Queensland Cabinet appointed a "Committee of Review to Investigate Flood Claims", the Chairman of which was a Stipendary Magistrate. With the exception of a brief period during which recourse was made to "temporary" inspectors from outside the public service, the whole scheme was implemented by a small group of public servants. The major Departments involved were Lands, State Works, Valuer General, Mines and the Queensland Housing Commission. Co-operation and assistance were also received from other Departments and Authorities, e.g. the Australian Department of Housing and Construction, the Justice Department and many local authority organisations. The administrative staff of the Committee, comprising young public servants from the numerous departments of the Queensland Government, varied from a maximum of sixty-four in February 1974 to a minimum of seven in May 1975, the month before the Committee finalised its activities. None of the administrative costs of implementing this scheme appear in any of the data we have discussed. The same comment can be made of all forms of assistance — no administrative costs for the Personal Distress and Hardship scheme or any of the concessional loan schemes have been included.

Taking into account all the expenditures we have been able to identify, we have calculated that all levels of government in Australia spent \$61,055,905 (in 1973-74 prices) as a result of flooding in Queensland in 1973-74. It must be emphasised that this figure should be regarded as a minimum estimate. The expenditures by each level of government and the relative proportion of this minimum estimate of total government expenditure are indicated in Table III-9.

Table III-9

ABSOLUTE AND PROPORTIONAL GOVERNMENT EXPENDITURES AND EXPENDITURE EQUIVALENTS FOLLOWING THE 1973-74 FLOODS IN QUEENSLAND, 1973-74

Level of Government	Expenditure \$ (1973-74 prices)	%
Australian Government	53,960,350	88.38
Queensland Government	5,797,010	9.49
Local Governments	1,298,545	2.13
Total	61,055,905	100.00

It is clear that the Australian Government was by far the most important source of funds following the 1973-74 floods in Queensland. This is not a particularly surprising conclusion, having regard to the post-1970-71 policy on natural disaster relief we outlined in Chapter II. The Queensland Government in fact provided less than 10 per cent of the funds we have been able to identify, while local governments supplied slightly more than 2 per cent. Recall that we have not been able to identify all costs, in particular damage to Australian Government assets and administrative costs of implementing the various assistance schemes.

We turn now to a consideration of government expenditures (and expenditure equivalents) in the catchment of the Brisbane River. The figures in this section of the chapter have been totals for the State as a whole. However, the data of Sections (1) and (2) are regional data and we wish to combine the data of these three sections. We could proceed in two ways. First, we could estimate damage for the State from the S.M.E.C. flood damage study of the Brisbane River or, secondly, we could attempt to obtain regional totals for the assistance categories of Table III-8.

⁷⁴ For an account of the myriad activities that were undertaken by existing and emergent government and non-government bodies, such as Red Cross, see Chamberlain *et al.*, *op. cit.* An extensive but not exhaustive list of assistance and relief bodies (both government and non-government) is given in that study, pp. 113-6.

The first procedure would be legitimate if the following two assumptions were met:

(a) the prevalence of flooding was uniform over all regions of the State; and

(b) economic activity was uniform over all regions of the State.

We have indicated at the beginning of this chapter that, although most parts of the State experienced flooding in 1973-74, flooding was more severe in some regions than in others. The first assumption is not met.

In Table III-10 we present some data on selected economic variables for the local government authorities that comprise the Brisbane River catchment, along with State totals for those same variables.⁷⁵

Table III-10

**THE RELATIVE IMPORTANCE OF CERTAIN ECONOMIC VARIABLES FOR
SELECTED LOCAL GOVERNMENT AUTHORITIES**

	Selected LGAs ^a	Queensland	Selected LGAs as a Percentage of State Total
Area (hectares)	1,389,049	172,800,000	0.80
Occupied Private Dwellings (1971)	231,184	512,600	45.10
Total Dwellings (1971)	245,488	569,078	43.14
Population (1971)	799,834	1,827,065	43.78
Manufacturing Employment (1973-74)	74,035	118,560	62.45
Retail Employment (1973-74)	63,234	135,428	46.69
Number of Sheep and Lambs (1974-75)	1,000	13,908,000	0.01
Number of Cattle (1974-75)	446,000	10,879,000	4.10
Area Under Crops (hectares) (1974-75)	51,000	1,897,000	2.69

Note: ^aIncludes Boonah Shire, Brisbane City, Crows Nest Shire, Esk Shire, Gatton Shire, Ipswich City, Kilcoy Shire, Laidley Shire and Moreton Shire.

Source: Australian Bureau of Statistics, *AMIS Printout*, Australian Bureau of Statistics, Canberra, Edition No. 4, 1978.

Although the Brisbane River catchment comprises less than 1 per cent of the total area of Queensland, almost 44 per cent of the State's population resides in this region, while the region contains approximately 45 per cent and 43 per cent of occupied private dwellings and total dwellings respectively. In terms of manufacturing and retail employment, the Brisbane River valley region accounts for approximately 62 per cent and 47 per cent of total Queensland employment respectively. On the other hand, the region accounts for very small proportions of Queensland pastoral and agricultural activity. It is quite clear that regional economic activity is far from uniform in the State of Queensland. It would be a most hazardous exercise to attempt to estimate damage in other regions from the available damage data on the Brisbane River catchment.

We have therefore chosen the second procedure. In Table III-11 we estimate grants and grant equivalents incurred in the Brisbane River valley by the Queensland Government. The regional data indicated in this table are not readily available; figures have been calculated from information supplied by six Queensland Government Departments and two Queensland Government instrumentalities.⁷⁶ In column (2) of this table we indicate the proportion of total assistance incurred in the Brisbane River valley.

⁷⁵ The catchment area of the Brisbane River includes all or most of nine local government authorities. Approximately half of the Shire of Boonah is in the catchment of the Brisbane River and the other half of this Shire forms part of the Logan River basin.

⁷⁶ We have obtained data for all categories other than Personal Distress and Hardship assistance. Regional data on this category are not available. We have assumed that the proportion of Personal Distress and Hardship assistance given in the Brisbane River valley is the same as that for Housing Repair and Rebuilding assistance.

Table III-11

**GRANTS AND GRANT EQUIVALENTS BY THE QUEENSLAND GOVERNMENT IN
THE BRISBANE RIVER CATCHMENT FOLLOWING THE 1973-74 FLOODS,
CONSTANT PRICES, 1973-74 to 1976-77**

Category of Assistance	Grants or Grant Equivalents \$ (1973-74 prices) (1)	Proportion of State Total % (2)
Personal Distress and Hardship	5,039,900	93.6
Housing Repair and Rebuilding	10,283,310	93.6
Restoration of State Government Assets	4,927,913	34.9
Restoration of Local and Semi-Government Assets	11,618,372	51.9
Assistance to Tertiary Education Institutions	634,162	100.0
Assistance to Primary Producers	—	0.0
Assistance to Small Businesses	815,164	74.6
Assistance to Sporting Bodies	32,417	92.3
Total	33,351,238	60.7

Source: Calculated from Table III-8 and information supplied by the Flood Damaged Homes Committee, the Agricultural Bank and the following Queensland Government Departments: Treasury, Auditor-General, Commercial and Industrial Development, Co-ordinator General, and Community and Welfare Services and Sport.

Of all government assistance in Queensland for floods in 1973-74, approximately 61 per cent was incurred in the catchment of the Brisbane River. It is interesting to note that the proportions of various types of assistance in the Brisbane River valley were far from uniform. In the case of tertiary education institutions, all assistance was incurred in the Brisbane River valley. On the other hand, no assistance was made available to primary producers in the Brisbane River valley.

(4) Redistribution by Private Appeal Funds

In addition to the disaster relief funds distributed by the public sector, charitable organisations in the private sector also provided relief. For donations in excess of \$2 to the private sector organisations to be tax deductible for the donor, such organisations had to be registered with the Australian Taxation Office as "Approved Funds".⁷⁷ A total of 98 funds were so registered. To gain some idea of the magnitude of the disaster relief handled by these organisations and the criteria used for distribution of such relief, we sent a questionnaire to each of the funds. A total of 66 responses were received.⁷⁸ The respondent funds distributed \$6,137,780.⁷⁹ Of this amount, the Brisbane Lord Mayor's Flood Disaster Fund distributed \$5,028,230, or 81.9 per cent of all voluntary relief we have been able to identify. The other major fund, the Queensland Flood Victims' Fund which was established by the Queensland Government, collected and distributed \$3,270,590.

The operation of the Queensland Flood Victims' Fund was unique, in that no grants were made to *individual* flood victims. Rather, the Fund operated by channelling donations the Fund received (from whatever source) to *regional* disaster funds for distribution to individuals. The regional funds included the Brisbane Lord Mayor's Flood Disaster Fund, the North West Queensland Flood Relief Committee and similar organisations. To add the funds donated to the Queensland Flood Relief Fund to the \$6,137,780 we have mentioned above would involve double counting.⁸⁰ In other words, it was not necessary for the Committee administering this Fund to address the complex questions of criteria of grants to individuals. Rather the Committee addressed the question of criteria for the *regional* distribution of donations received by the Queensland Flood Victims Fund among *other* funds throughout the State. No information is available on the criteria that were employed in undertaking *this* distribution function.

⁷⁷ See *Income Tax Assessment Act* 1973, Section 78(1)(a)(iii).

⁷⁸ The non-respondent funds were all relatively small and would have accounted for only a small proportion of total funds distributed by voluntary appeal funds.

⁷⁹ From the information available to us, we have ascertained that no redistributions by these private sector organisations were made to governments, firms or community organisations.

⁸⁰ We sought information on inter-fund transfers in our questionnaire to voluntary appeal funds and have taken all such "double counting" problems into account in analysing the data.

We have examined the funds distributed and have calculated the average grant per flooded home for each of the geographical regions in Queensland where flooding occurred. We have determined that the average grant per flooded home varies considerably between regions: the minimum grant was \$173 per flooded home for the fund in the Maryborough-Burrum region and the maximum grant was \$1,044 per flooded home for the regional fund in the Moreton Shire. We can discern no pattern in the regional distribution that has taken place, using the number of flooded homes as the variable. We can offer no further comment on this matter.

We have calculated that an amount of approximately \$6,024,104 was distributed to flood victims in the Brisbane River valley. This represents 98.15 per cent of all voluntary charity we have been able to identify. There may be some inaccuracy in this estimate as some funds which gave, say, a Brisbane address may have distributed funds to flood victims in other regions. However, such errors are relatively unimportant as most of the voluntary charity (\$5,028,230) was distributed by the Brisbane Lord Mayor's Flood Disaster Fund.

We present in Table III-12 a summary of the criteria employed by the respondent funds in distributing disaster relief. It is clear that the bulk of relief funds was distributed to all who incurred damage, the amount of relief being determined by the extent of the damage. There is no disaggregation of the purposes for which relief was granted as is the case with public sector relief.

Table III-12

SUMMARY OF CRITERIA USED BY RESPONDENT PRIVATE APPEAL FUNDS FOR DISTRIBUTION OF DISASTER RELIEF, QUEENSLAND, 1973-74

Criteria for Determining Eligibility	Number of Respondents	% of Respondents	% of Funds Accounted for by These Respondents
(a) Present Employee or Present Member	47	71.21	12.46
(b) Past Employee or Past Member	6	9.09	2.76
(c) All who Incurred Flood Damage	27	40.91	88.90
(d) Geographical Location	5	7.58	1.82
(e) Other	8	12.12	1.06
Criteria for Determining Amount of Relief			
(a) Person's or Family's Income	8	12.12	3.67
(b) Person's or Family's Wealth	4	6.06	0.36
(c) Extent of Damage	52	78.79	96.32
(d) Length of Employment or Membership	4	6.06	0.53
(e) Relief Received from Other Organisations	22	33.33	8.42
(f) Other	10	15.15	1.63

Source: Survey data.

We conclude by making two points. Not surprisingly in view of the different coverage and nature of organisations that set up voluntary appeal funds under the *Income Tax Assessment Act* 1973, the average assistance received by flood victims from the respondent funds varied considerably.⁸¹ From the data available to us we have been able to determine that the lowest relief per recipient was \$19.60 and the highest relief per recipient was \$8,001. Secondly, the criteria presented in Table III-12 obscure some of the finer points of determining eligibility and the amount

⁸¹ The organisations that set up the 98 "Approved Funds" included regional entities such as the Ipswich Disaster Relief Fund, religious denominations, employment entities (firms, government departments), mutual interest associations, e.g. ethnic groups.

of assistance. For example, one fund determined eligibility essentially on the basis of whether damage was incurred by landlords excluded from assistance under the public or government schemes (see Chapter V). Another example relates to the use of relief received from other organisations as a criterion for determining the amount of relief granted. In one case, an "extra allocation" was made if the injured party had received no relief from other organisations but, if he had, no account was taken of the amount of such relief. Nevertheless, the table does provide us with a broad indication of the criteria used.

(5) Some Conclusions

We now give a final answer to the questions "what was total government assistance, and what were the relative proportions funded by the three levels of government, following the 1973-74 floods in Queensland"?

First, we consider again voluntary redistributions by private philanthropy. In the previous section we reported the results of our survey of the 98 voluntary appeal funds that were registered under Section 78(1)(a)(iii) of the *Income Tax Assessment Act* 1973. Recall that the central feature of such registration was that donors to such voluntary funds could claim donations in excess of \$2 as deductions from their taxable incomes. This means that only a *part* of the \$6,137,780 distributed to individuals was funded from private sources as the donors could claim a *subsidy* from the Australian Government for their philanthropic behaviour.

The amount of the Australian Government subsidy to the philanthropist depended on two factors: first, the amount of his or her donation to a registered appeal fund; and, second, the donor's marginal rate of tax. Such deductions from the tax base are allowed under the *Income Tax Assessment Act* 1973 to all donors of *all* registered charitable funds: the deduction is not restricted to flood victims' appeal funds.

Such a mechanism of government subsidisation of private philanthropy in general has been subject to criticism. "The government thus in effect subsidises the charities favored by the rich to a far greater extent than those favored by the poor . . . In no other area do the wealthy have such a preponderant and explicit influence in determining the manner in which funds indirectly provided by the government are to be allocated."⁸² We are not concerned with such equity arguments in this context, or with economic efficiency arguments to justify government subsidies to charity.⁸³ The existence of a subsidy means simply that not all the funds collected by voluntary appeal funds for flood victims were obtained from the private sector: the mechanism of the taxation subsidy produces a result whereby the Australian Government finances a proportion of such "private" charity.

We will assume that the marginal rate of tax, on average for donors to voluntary flood appeal funds in 1974, was 25 per cent.⁸⁴ What this implies is that of the \$6,137,780 donated to private appeal funds, only three-quarters or \$4,603,335 were obtained from the private sector: the remainder, \$1,534,445, was provided by an Australian Government subsidy to the donors through taxation deductions.

An implication of this conclusion is that the data presented in Table III-9 are misleading, in that they refer only to funds that appear on the expenditure side of governments' budgets and ignore funds made available through decreases in taxation revenue. Given the arguments presented above, the level of Australian Government assistance should be increased by \$1,534,445. We make the necessary adjustments in Table III-13.

⁸² W. Vickrey, "Private Philanthropy and Public Finance", in E. S. Phelps (ed.), *Altruism, Morality and Economic Theory*, Russell Sage Foundation, New York, 1975, p. 153. See also J. M. Schaefer, "Philanthropic Contributions: Their Equity and Efficiency", *Quarterly Review of Economics and Business*, Vol. 8, Summer 1968.

⁸³ See H. M. Hochman and J. D. Rodgers, "Utility Interdependence and Income Transfers through Charity", in K. E. Boulding et al (eds), *Transfers in an Urbanised Economy: Theories and Effects of the Grants Economy*, Wadsworth, Belmont, 1973; and H. M. Hochman and J. D. Rodgers, "The Optimal Tax Treatment of Charitable Contributions", *National Tax Journal*, Vol. XXX, March 1977.

⁸⁴ For a detailed discussion see M. S. Feldstein, "The Income Tax and Charitable Contributions: Part I — Aggregate and Distributional Effects", *National Tax Journal*, Vol. XXVIII, March 1975.

Table III-13
ABSOLUTE AND RELATIVE ASSISTANCE^a BY LEVELS OF GOVERNMENT
FOLLOWING THE 1973-74 FLOODS IN QUEENSLAND

Level of Government	Absolute Assistance \$	Percentage %
Australian Government	55,494,795	88.66
Queensland Government	5,797,010	9.26
Local Government	1,298,545	2.08
Total	62,590,350	100.00

Note: ^a"Assistance" in this table includes both expenditures and decreases in taxation resulting from donations to private philanthropy.

Source: Table III-9 and text.

The major effect of Australian Government assistance through taxation deductions is to increase total government assistance by the extent of the subsidy as calculated. This in turn slightly increases the relative proportion of total assistance provided by the Australian Government, from 88.38 per cent⁸⁵ to 88.66 per cent, and decreases the relative proportions of both State and local government assistance. This conclusion is still subject to the qualifications we mentioned previously, namely that we have not identified all government expenditures, in particular some Australian Government expenditures by the Defence Department on emergency services and for the restoration of damaged Australian Government assets, Queensland Government expenditures on administration of various assistance schemes, and minor damage to local government assets.

We are now in a position whereby we can determine the proportions of flood damage in the Brisbane River valley in 1974 that were borne by other members of society through the pooling mechanism of insurance and through private philanthropy and government, and by the flood victims themselves.

In column (1) of Table III-14 we aggregate the S.M.E.C. damage data for the categories "Residential and Residential Clean-Up" and "Motor Vehicles and Boats", as we are interested in considering damage borne by individuals as victims in respect of consumption activities. There may be an overestimate in undertaking this procedure as there may have been some damaged motor vehicles and boats that were owned by commercial and industrial firms, rather than by individuals as durable consumption items. We have also aggregated some items into "Miscellaneous and Public Utilities".

The categories of government assistance to "Primary Producers" and "Small Businesses" in Table III-11 clearly relate to the damage category of private sector production activity, the first row of Table III-14. On the other hand, assistance in the form of "Personal Distress and Hardship" and "Housing Repair and Rebuilding" relates to private sector consumption activity, the second row of Table III-14. All other government assistance, for sporting bodies, tertiary education institutions and the restoration of State, local and semi-government assets, relates to the "Miscellaneous and Public Utilities" damage category of Table III-14.

We have arranged the data of Table III-14 in such a way as to highlight the extent to which flood damage has been borne by the recipients of damage and by people other than the recipients of damage. In this context we conceive of insurance, government and private philanthropy as three societal mechanisms whereby the damage from a natural disaster is borne by persons other than those immediately affected by that natural disaster.⁸⁶ We have commented previ-

⁸⁵ See Table III-9.

⁸⁶ This statement is not strictly correct in the case of insurance for those persons who paid premiums on various types of policies which had extensions for flood cover. The claims of those flood victims would be met, in small part, by the premiums that the flood victims had paid in previous years. Thus, insurance involves not only a redistribution from others to the victims of a natural disaster but also an inter-temporal redistribution for the insurance claimants. A similar comment could be made in the case of government assistance to flood victims (individuals or firms) who were also taxpayers.

Table III-14
ABSOLUTE AND RELATIVE DAMAGE BORNE BY INSURANCE, GOVERNMENT, CHARITIES AND FLOODED ENTITIES, BRISBANE RIVER VALLEY, 1973-74 FLOOD

Category of Damage	Damage ^a (1)	Damage Borne by Other People						Damage Borne by Flooded Entities	
		Insurance ^b		Government ^c		Philanthropy ^d		\$ (8)	% (9)
		\$ (2)	% (3)	\$ (4)	% (5)	\$ (6)	% (7)		
Commercial and Industrial	114,400,000	55,839,000	48.81	815,164	0.71	—	—	57,745,836	50.48
Residential, Residential Clean-Up, Motor Vehicles and Boats	41,500,000	11,937,000	28.76	16,829,236	40.55	4,518,078	10.89	8,215,686	19.80
Miscellaneous and Public Utilities	22,400,000	—	—	17,212,864	76.84	—	—	5,187,136	23.16
Total	178,000,000	67,776,000	—	34,857,264	—	4,518,078	—	71,148,658	—

Sources: aTable III-1.

bTable III-3.

cTable III-11.

dSee Chapter III Section (4).

ously on the varying degrees to which the pooling mechanism of insurance has covered damage from this natural disaster: approximately only 38 per cent of total damage was borne by this mechanism.

Private philanthropy was quantitatively the least important societal mechanism for sharing the cost of the natural disaster we are considering here. Approximately 2.5 per cent of total damage was borne by this mechanism.

There is a complication in the data of Table III-14 that should be recognised before we comment on the role of government. In row 3 columns (8) and (9) we indicate that \$5,187,136 or 23.16 per cent of total damage in the "Miscellaneous and Public Utility" category was borne by the flooded entities themselves. To understand what this means, recall that this damage category relates basically to public facilities of one kind or another, and that the source of information on restoration of public assets by government has been the record of payments under the *Queensland Flood Relief Act 1974*. We pointed out in Section (1) that a major omission from the data was restoration expenditure undertaken by the Australian Government on its own assets. Such expenditure was undertaken by Australian Government departments through their own departmental accounts and did not take the form of a payment to the State under the *Queensland Flood Relief Act 1974*. Although a part of this "unaccounted for" damage may relate to communal organisations such as sporting bodies whose assets were damaged by flood, it is not unreasonable to assume that the damage was caused to Australian Government assets.

Given this assumption, we can add the figure of \$5,187,136 (row 3 column (8)) to the total damage figure of \$34,857,264 borne by Government, (column (4)) to determine total government expenditure. We can then conclude that of total damage incurred in the Brisbane River valley in 1973-74, 22.5 per cent was borne by government. It follows from this same assumption that flooded entities (whether individuals or firms) bore 37.06 per cent of total damage. A qualification needs to be made with respect to these proportions. We know that many firms regarded costs associated with flood damage as costs of running a business and hence shifted those costs to the Australian taxpayer. However, we have no information on the extent to which this occurred. Thus the conclusion that 22.5 per cent of damage was borne by government must be regarded as a *minimum* estimate; and the estimate that 37.06 per cent was borne by flooded entities must be regarded as a *maximum* estimate.

We pointed out in Section (2) that the proportion of damage borne by insurance was not uniform for different damage categories. More particularly, insurance covered almost 49 per cent of "Commercial and Industrial" damage and only about 29 per cent of what may be regarded as private sector consumption damage (row 2 of Table III-14). As with insurance coverage, government assistance was non-uniform across damage categories. Government assistance for damage to private sector production assets (excluding the taxation complication mentioned in the previous paragraph) covered only 0.71 per cent of "Commercial and Industrial" damage (row 1 column (5)). However, government assistance to private sector consumption activity (row 2 column (5)) met almost 41 per cent of such damage. And, of course, the government sector met 100 per cent of damage in the "Miscellaneous and Public Utilities" damage category (row 3 columns (5) and (9)). Recall, however, that this is an overestimate as some damage in this category related to voluntary communal organisations, such as sporting bodies.

All private charity, unlike the other societal mechanisms for sharing the costs of a natural disaster, was confined to a single damage category, that of private sector consumption activity (row 2 column (7)). Voluntary charity bore almost 11 per cent of such damage.

Not surprisingly, then, the proportion of damage borne by the flood victims themselves varied between categories. Over 50 per cent of "Commercial and Industrial" damage was borne by the firms so affected. Recall, however, that this is a *maximum* estimate; the proportion will have been less than is indicated in row 1 column (9) because of taxation write-offs. The proportion of private sector consumption activity borne by the flood victims themselves was almost 20 per cent (row 2 column (9)).

In the remainder of this monograph, we will be concerned with damage to private sector consumption assets. Our concern in the next chapter will be to examine some relevant economic theory concerning government participation in natural disaster relief. In Chapter V, we will

examine in detail the criteria that were used to distribute government relief to persons whose private sector consumption assets were damaged or destroyed by floodwaters in 1973-74. In other words, our concern will be with the application of those means tests that produced the situation whereby, in aggregate, governments met almost 41 per cent of such damage and the flood victims themselves bore almost 20 per cent of the damage.

IV EFFICIENCY AND EQUITY IN THE DISTRIBUTION OF NATURAL DISASTER RELIEF TO INDIVIDUALS — THEORETICAL ASPECTS

The remainder of this monograph will be concerned with the Australian Government specific purpose grants to the Queensland Government for natural disaster relief for *individuals* affected by the January 1974 flood. In particular, we will be concerned with evaluating the criteria agreed to by the Australian and Queensland Governments for distributing such relief to individuals and with proposing some alternative possible arrangements. Our attention will be focused on relief payments to individuals in the form of grants rather than loans.

Evaluation of the criteria for distributing grants implies the existence of a benchmark for evaluation. If the grants are designed solely to achieve an allocative or efficiency objective by providing insurance cover, one would expect some degree of risk-discrimination in the distribution of the grants, or at least no relationship between an individual's grant and his economic position.

However, in the relief scheme for individuals affected by the January 1974 flood there was, as we shall see in the first section of Chapter V, a conspicuous attempt to relate an individual's grant and his economic position. It would thus seem that a distributional objective was being pursued. Under these circumstances, the grants take the form of negative taxes. The benchmark for evaluation is then provided by the theory of public finance and, in particular, by the principles of efficiency and equity in taxation.

(1) Efficiency in Taxation

An efficient tax is one which, to raise a given amount of revenue, minimises the burden placed on those paying the tax. For this to be achieved, the tax must be levied in such a way that it does not distort the objective rates of substitution between any alternatives which face the individual. Alternatively, we may say that, if the objective is to raise a given amount of revenue, the amount of an individual's tax payment should not be dependent upon how he chooses to allocate his income, wealth, time and so on between the alternatives available to him. This is commonly referred to as the principle of neutrality or the principle of avoidance of excess burden in taxation.¹

A few simple examples will help to clarify the meaning of this principle. An excise tax on motor vehicles will change the exchange ratio between motor vehicles and other commodities and will give rise to a substitution effect in favour of other commodities. An income tax will change the work/leisure trade-off, reducing the opportunity cost of leisure. A tax on consumption expenditure will give rise to a substitution effect in favour of saving. A tax on certain forms of wealth will cause a change in the relative rates of return available from the various types of assets. In general, the excess burden arises because a tax changes the slope of the budget constraint facing the individual, giving rise to a substitution effect as well as an income effect. This can be demonstrated by the use of conventional indifference curve analysis.² The problem arises if the imposition of a tax gives the individual an incentive to "wriggle" so as to reduce his tax commitment, to use a term coined by Gates.³

It may be that in some circumstances the government wants to induce "wriggling", for example, to discourage consumption of a commodity which it feels is undesirable (Musgrave's merit wants). However, this paternalistic view would appear to be at odds with the value premise underlying the efficiency concept, namely, that individual preferences should count. Nevertheless, there may be a case for induced "wriggling" where the tax is designed to internalise an external cost.

¹ A detailed discussion together with references to the voluminous literature on the subject can be found in R. A. Musgrave, *The Theory of Public Finance*, McGraw-Hill, New York, 1959, Chapter 7.

² *Ibid.*, p. 144.

³ R. C. Gates, "The Effect of Taxation on Incentive", reprinted in J. Dixon (ed.), *The Public Sector*, Penguin, Ringwood, 1972, p. 215.

It might seem that the only way of avoiding any excess burden in taxation is to use a poll tax or a lump-sum tax, which each person has to pay regardless of whether he works or not, of what commodities he consumes or of any other characteristics. However, even this tax may give rise to an excess burden if it is imposed per head and not per family unit, for it may then affect the individual's decisions concerning reproduction.⁴ Also, it may affect decisions concerning migration.

Thus it appears that, in practice, an excess burden will inevitably arise in the raising of taxation revenue. Attention must then be directed to minimising the excess burden that does exist. This can be achieved by reducing the scope for the "wriggling" which leads to non-optimal behaviour. To quote Musgrave: "... we are left with the common-sense view that the excess burden of more general taxes tends to be smaller than that of selective taxes; and with the formal conclusion that taxes on goods and services which have a low rate of substitution tend to be superior to taxes on those which have high rates of substitution."⁵

The principle of neutrality in taxation can be applied in an analogous fashion to distribution of transfer payments. If an individual's eligibility for a transfer payment depends upon the way he spends his income or on his asset portfolio composition, he will have an incentive to "wriggle" so as to increase his entitlement. He would suffer a welfare loss as compared with a situation in which he received the same transfer payment without a change in the objective substitution ratios which he faces.⁶

(2) Equity in Taxation

The principle of equity in taxation requires that the tax burden be distributed among individuals so as to achieve some preconceived notion of "justice" or "fairness". There are two fundamental approaches to the determination of individuals' tax burdens — the benefit principle and the ability-to-pay principle.⁷ The basic tenet of the benefit approach is that the amount of tax a person pays should depend upon the benefits he receives from government expenditures. This views each individual as indulging in a *quid pro quo* transaction with the government, the taxes being the "prices" paid for the benefits of government expenditures.

Advocates of the ability-to-pay approach deny the possibility of imputing benefit shares to individuals, arguing that the distribution of the tax burden should be based upon an individual's ability-to-pay. Early writers confined their attention to the distribution of tax payments, but some later writers, in particular Pigou and Dalton, sought to determine jointly the distribution of tax payments and the size and composition of government expenditures.

The apparent conflict between these approaches may be resolved to some extent by viewing them in terms of Musgrave's allocation and distribution branches of the public household. It could be argued that the benefit principle is not designed to solve completely the problem of distributing the tax burden. In the writings of Wicksell and Lindahl, two of the major protagonists of the benefit approach, they advocate such an approach on the assumption that the initial distribution of income is just.⁸ Musgrave argues that "the crux of the ability-to-pay doctrine itself relates to the establishment of this distribution and not to the pricing of social goods".⁹ Thus "the benefit approach, by its very nature, cannot solve the problem of the Distribution and the Stabilization Branches. However, in dealing with the Allocation Branch, this view has the great merit of tying the choice of public services to the preferences of the individual members of the community".¹⁰

⁴ C. M. Allan, *The Theory of Taxation*, Penguin, Harmondsworth, 1971, pp. 93-4.

⁵ *Op. cit.*, p. 157.

⁶ This is the basis of the traditional economic case for redistribution through income supplements rather than through specific commodity subsidies. For a demonstration of this proposition using indifference curve analysis, see C. L. Cole, *Microeconomics: A Contemporary Approach*, Harcourt Brace Jovanovich, New York, 1973, pp. 87-92.

⁷ A comprehensive discussion of these principles can be found in Musgrave, *op. cit.*, Chapters 4 and 5 respectively.

⁸ English translations of excerpts from the writings of Wicksell and Lindahl can be found in R. A. Musgrave and A. T. Peacock (eds), *Classics in the Theory of Public Finance*, Macmillan, London, 1958. See also Musgrave, *op. cit.*, Chapter 4.

⁹ *Op. cit.*, p. 78.

¹⁰ *Op. cit.*, p. 62.

Musgrave's approach presupposes a legitimate dichotomy between questions of allocation and distribution, a dichotomy which has been at the core of the controversy in welfare economics for many years. In terms of the welfare economics of public finance, Samuelson's classic papers on the pure theory of public expenditures demonstrated that questions of allocation and distribution were intimately related in determining the optimal supply of public goods.¹¹ Despite this theoretical triumph which Musgrave concedes "meets the test of theoretical rigour and sweeping elegance and ranks among the great contributions to the theory of welfare economics as applies to public finance",¹² Musgrave continues to express the conviction "that the separation between allocation and distribution aspects offers a more useful approach to public finance theory . . . Unless a basis for separation is established, we are left with a theory of public expenditures or, better, resource use in which the tax problem has no conceptual place. But without this, the theory gives little aid to the analysis of fiscal problems as they actually arise."¹³

Transfer payments or negative taxes are a means of effecting a redistribution of income. Under Musgrave's dichotomy, they would fall within the ambit of the distribution branch. The use of the ability-to-pay approach would then be appropriate in appraising the equity effects of such payments, for it is this approach which seeks to establish a just distribution of income.¹⁴

The ability-to-pay approach is based upon the more general proposition "that *all* should be treated equally under the law".¹⁵ In terms of the distribution of tax burdens, this was interpreted as requiring that all individuals should bear an equal sacrifice. In order to translate this normative principle into policy prescriptions, two matters need to be clarified. First, an objective index of ability-to-pay needs to be constructed so that subjective sacrifice can be translated into measurable quantities. Secondly, the exact meaning of the term "equal sacrifice" needs to be specified.

The objective index of ability-to-pay which was agreed upon in the later stages of development of the doctrine was an individual's income. Loss of income could be taken as a measure of subjective sacrifice where the latter was taken to mean loss of utility. Of course, an exact relationship between income and utility must be specified for the doctrine to be operational. For the moment we will ignore the problems of defining income for this purpose and return to this issue later.

With regard to the meaning of the term "equal sacrifice", three distinct concepts have emerged:

- (a) equal absolute sacrifice — each individual bears the same loss of total utility, or the same loss of utility in absolute terms;
- (b) equal proportional sacrifice — the ratio of lost utility to total utility is the same for each individual;
- (c) equal marginal sacrifice (or least aggregate sacrifice) — the loss of utility at the margin is the same for each individual.

It is clear that the ability-to-pay approach is based upon the assumption that utility is measurable and that interpersonal comparisons of utility are possible. "Without this assumption, the entire type of discussion now under consideration breaks down."¹⁶ The ability-to-pay approach is thus unambiguously in the "old" welfare economics tradition.

¹¹ P. A. Samuelson, "The Pure Theory of Public Expenditure", *Review of Economics and Statistics*, Vol. 36, 1954, pp. 387-9; P. A. Samuelson, "Diagrammatic Exposition of a Theory of Public Expenditure", *Review of Economics and Statistics*, Vol. 37, 1955, pp. 350-6. Both of these papers are reprinted in R. W. Houghton (ed.), *Public Finance*, Penguin, Harmondsworth, 1970.

¹² R. A. Musgrave, "Provision for Social Goods," in J. Margolis and H. Guitton (eds), *Public Economics*, Macmillan, London, 1969, p. 130.

¹³ *Ibid.*, p. 133. For a summary of the literature, see J. Burkhead and J. Miner, *Public Expenditure*, Macmillan, New York, 1971, Chapter 3.

¹⁴ The benefit approach, being properly placed in the allocation branch, is of no use in appraising taxes and transfers in the distribution branch. To quote Simons: "where the government undertakes deliberately to subsidize certain classes (the economically unfit) or certain kinds of consumption (education, recreation), taxation according to benefit is sheer contradiction". H. C. Simons, *Personal Income Taxation*, University of Chicago Press, Chicago, 1938, p. 4.

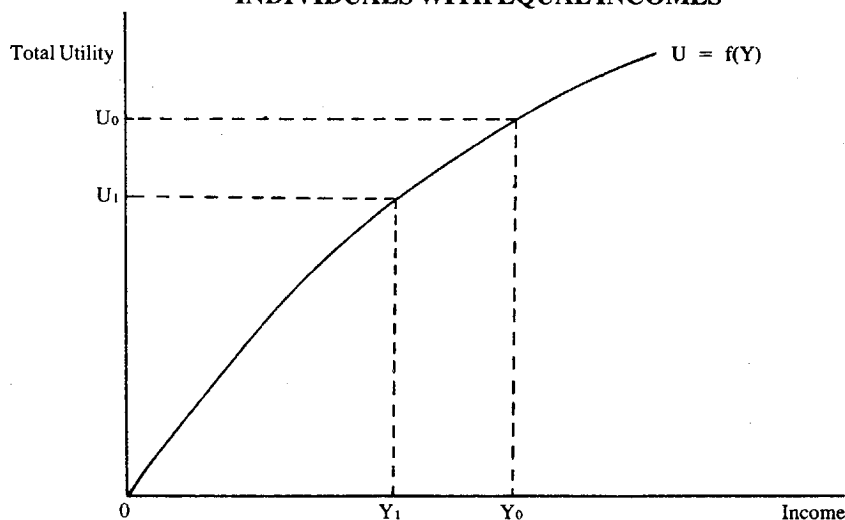
¹⁵ Musgrave, *The Theory of Public Finance*, *op. cit.*, p. 92 (emphasis in original).

¹⁶ *Ibid.*, p. 96.

The link between the various concepts of equal sacrifice and the distribution of the tax burden is provided by the income-utility function. Figure IV-1 depicts a total utility of income function on the assumption that the marginal utility of income diminishes as income increases. Assume that all individuals have the same income-utility function. The situations of two or more individuals can then be depicted by reference to the one income-utility function in Figure IV-1. In demonstrating each of the three concepts of equal sacrifice, we will first of all consider individuals who have the same level of income Y_0 giving total utility U_0 . Under equal absolute sacrifice, each individual should bear the same absolute loss of utility as a result of taxation. It is clear from the diagram that if one individual on income level Y_0 is taxed an amount $(Y_0 - Y_1)$ then *all* individuals on income level Y_0 must be taxed by the same amount if they are all to sustain the same absolute loss of utility $(U_0 - U_1)$. Equal proportional sacrifice requires that the ratio of utility lost to total utility, or $(U_0 - U_1)/U_0$ in Figure IV-1, be the same for all individuals. In terms of individuals with the same income level such as Y_0 in Figure IV-1, it is again evident that, to achieve equal proportional sacrifice, they should all pay the same amount of tax. Equal marginal sacrifice requires the loss of utility at the margin to be the same for each individual. For all individuals on the same income level Y_0 , again they should pay the same absolute amount of tax $(Y_0 - Y_1)$ so that the marginal utility of post-tax income MU_1 is the same for each. Thus all three concepts of equal sacrifice indicate that individuals with equal incomes should pay the same amount of tax.

Figure IV-1

**INCOME-UTILITY FUNCTION WITH DIMINISHING MARGINAL UTILITY OF INCOME
— INDIVIDUALS WITH EQUAL INCOMES**



The income-utility function need not necessarily possess the characteristic of a declining marginal utility of income. It is possible that the marginal utility of income could be constant or increasing. If we take into consideration these additional possibilities for the income-utility function,¹⁷ it can be seen that there are nine possible combinations of income-utility functions and concepts of equal sacrifice. These are illustrated in Table IV-1.

Our discussion so far has been concerned with a particular situation relating to cases 1, 2 and 3, namely the situation where individuals have equal pre-tax incomes.¹⁸ In each case, the implication for the tax structure was the same — individuals with equal incomes pay equal

¹⁷ We are ignoring "devious" cases where the income-utility function may exhibit diminishing, constant and increasing marginal utility of income over different ranges of the function.

¹⁸ Table IV-1 does not distinguish between people with equal incomes and people with unequal incomes. Each particular case in the matrix includes all persons, regardless of income. A more complete formulation would be to construct a matrix that incorporates a distinction between people with equal and unequal incomes. Such a matrix would then contain 18 cases.

amounts of tax. Indeed, this conclusion holds in the remaining six cases also. It is easy to envisage an income-utility function exhibiting constant or increasing marginal utility of income. If attention is again focused on individuals with equal incomes, it will be seen that any concept of equal sacrifice will again generate exactly the same conclusion. Thus, if we assume utility is measurable and interpersonally comparable and that all individuals have the same income-utility function then, regardless of which concept of equal sacrifice is adopted or how the income-utility function behaves,¹⁹ the conclusion is that individuals with equal income should pay equal amounts of tax.²⁰ This is referred to as the principle of horizontal equity in taxation and is "perhaps the most widely accepted principle of equity in taxation".²¹

Table IV-1

COMBINATIONS OF SACRIFICE CONCEPTS AND INCOME-UTILITY FUNCTIONS

	Diminishing Marginal Utility of Income	Constant Marginal Utility of Income	Increasing Marginal Utility of Income
Equal Absolute Sacrifice	1	4	7
Equal Proportional Sacrifice	2	5	8
Equal Marginal Sacrifice	3	6	9

Let us now consider the tax treatment of individuals with different levels of income. For illustrative purposes, diminishing marginal utility of income is again assumed. Figure IV-2 depicts the relevant income-utility function, with two individuals A and B whose pre-tax income levels are Y_A and Y_B respectively. Under the principle of equal absolute sacrifice (case 1 in Table IV-1), A and B must suffer the same utility loss in absolute terms as a result of taxation, that is, $(U_B - U_B')$ must equal $(U_A - U_A')$ in Figure IV-2. For this condition to be fulfilled, B must surrender more income in absolute terms than A, i.e. $(Y_B - Y_B')$ must exceed $(Y_A - Y_A')$. With equal proportional sacrifice (case 2), the ratio of B's loss of utility to his total utility must be equal to the same ratio for A. This is illustrated in Figure IV-2 with the equality of the following ratios:

$$\frac{U_B - U_B'}{U_B} = \frac{U_A - U_A'}{U_A}$$

B again pays more tax than A. Under equal marginal sacrifice (case 3), B would bear all tax up to an amount equal to $(Y_B - Y_A)$, after which any extra tax would be divided evenly between A and B. Again, B bears more tax than A. It is interesting to note that the equal marginal sacrifice principle implies a completely equalised distribution of income.²²

Thus, if we assume diminishing marginal utility of income then, regardless of which of the three concepts of equal sacrifice is adopted, individuals with higher incomes will pay higher taxes in absolute terms. This is not the case, however, if the marginal utility of income is constant or increasing. This encompasses cases 4-9 in Table IV-1. Although the results can be illustrated

¹⁹ Ignoring the "devious" cases referred to in n.17.

²⁰ Hence Pigou's statement that "tax arrangements that conform to the principle of least sacrifice always and necessarily conform also to the principle of equal sacrifice among similar and similarly situated persons". A. C. Pigou, *A Study in Public Finance*, 2nd edn, Macmillan, London, 1929, p.63.

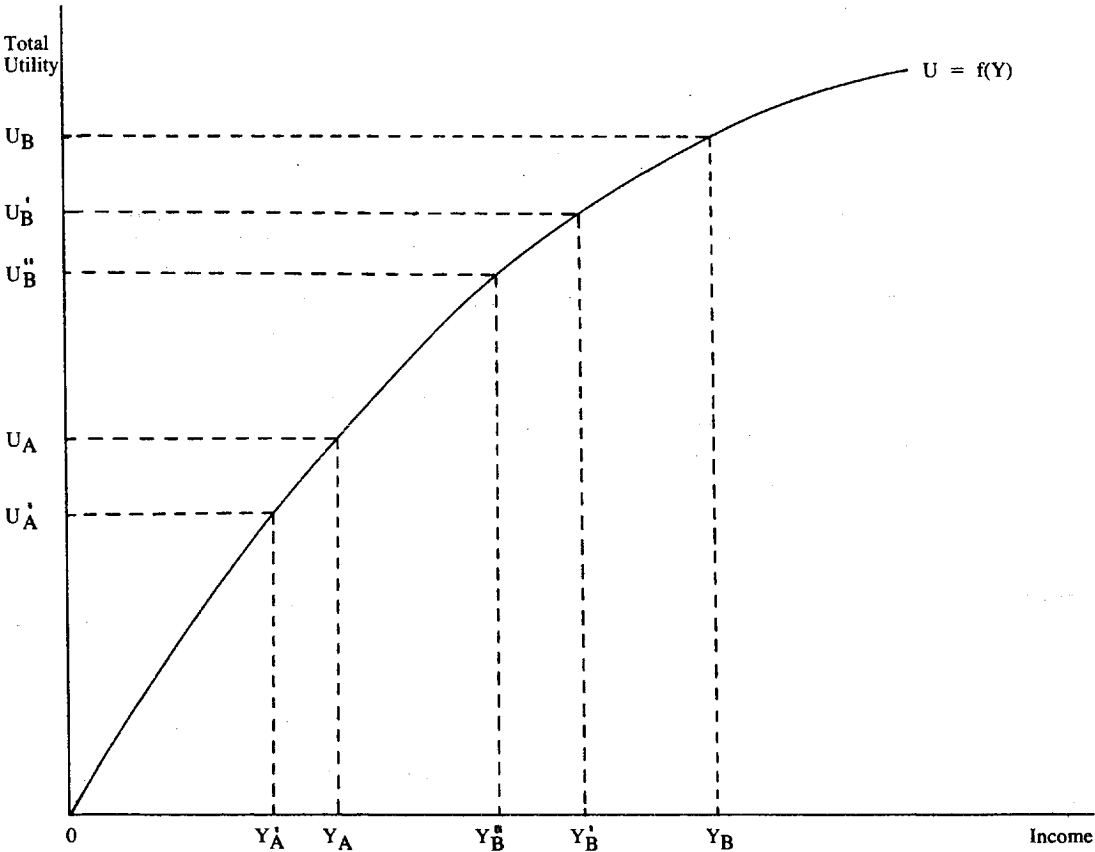
²¹ Musgrave, *The Theory of Public Finance*, op. cit., p.160.

²² In Pigou's words: "If we push further toward the concrete, it appears that a system of equi-marginal sacrifice fully carried out would involve lopping off the tops of all incomes above the minimum income and leaving everybody, after taxation, with equal incomes." Pigou, op.cit., p.78. It is interesting to note that Pigou based his argument for the equi-marginal or least aggregate sacrifice principle on efficiency rather than equity. "[T]here is general agreement that all of a government's activity should be regulated with a view to promoting, in the highest possible degree, the welfare of its citizens . . . So far as political theory is concerned, maximum aggregate welfare is everywhere accepted as the right goal of government . . . In the special field of taxation, this general principle is identical with the principle of least sacrifice. Its validity appears to me to be given directly in intuition." Op. cit., pp.62-3. This argument can be regarded as the cardinal utility counterpart of the more recent "efficient redistribution" literature based on the ordinal utility-framework as first presented by H. M. Hochman and J. D. Rodgers, "Pareto Optimal Redistribution", *American Economic Review*, Vol. 59, September 1969, pp. 542-57.

diagrammatically as has been done in Figure IV-2 for diminishing marginal utility of income, we will simply summarise the results in matrix form (see Table IV-2).

Figure IV-2

INCOME-UTILITY FUNCTION WITH DIMINISHING MARGINAL UTILITY OF INCOME
— INDIVIDUALS WITH UNEQUAL INCOMES



The word “increase” in any cell means that, with the particular combination of equal sacrifice concept and income-utility function, an individual’s tax payments will increase in absolute terms as his income increases. An analogous interpretation applies to the words “same” and “decrease”.

The question marks relating to cases 6 and 8 require explanation. In case 6, since the marginal utility of income is constant, any distribution of the tax bill will be as equitable as any other because all will satisfy equal marginal sacrifice. In case 8, tax payments may or may not increase as income increases depending upon the particular shape of the income-utility function. This can be seen by first envisaging the case 5 situation where the total-utility-of-income function is a straight line through the origin. Equal proportional sacrifice then requires higher tax payments as income increases. Now if the function changes slightly so as to exhibit increasing marginal utility of income, tax payments may still need to increase as income increases. However, because the marginal utility of income increases at a faster rate, a point will be reached where equal proportional sacrifice will then require tax payments to fall as income increases. Hence there is a question mark relating to case 8 in Table IV-2.

Table IV-2
BEHAVIOUR OF TAX PAYMENTS AS INCOME INCREASES

	Diminishing Marginal Utility of Income	Constant Marginal Utility of Income	Increasing Marginal Utility of Income
Equal Absolute Sacrifice	1 Increase	4 Same	7 Decrease
Equal Proportional Sacrifice	2 Increase	5 Increase	8 ?
Equal Marginal Sacrifice	3 Increase	6 ?	9 Decrease

In most cases, then, the ability-to-pay doctrine requires that people in unequal positions be treated unequally with respect to the absolute amount of income surrendered as taxation. This is known as the principle of vertical equity in taxation. Again it is noted that, if diminishing marginal utility of income is assumed, individuals with higher incomes should pay more tax in absolute terms than individuals with lower incomes regardless of which of the three concepts of equal sacrifice is adopted.

We do not intend to address the question of the *degree* to which individuals in unequal economic positions should be treated unequally, although writers on this subject have usually considered this question as an extension of the above analysis. This question is concerned with whether the actual income tax rate structure should be progressive, proportional or regressive. For our purposes, it is sufficient to note that, in terms of the above analysis, the requirements for a progressive rate structure are more stringent than those required to generate the proposition that tax payments should increase as income increases. For example, in case 1, tax payments which are positively correlated with income are quite consistent with a regressive rate structure. This point is illustrated in Figure IV-3, which depicts tax payments as a function of income. If progression and regression are defined according to whether the average rate of tax increases or decreases respectively, curve OB embodies a progressive rate structure while curve OC embodies a regressive rate structure. Curve OA depicts a proportional rate of tax. Each of the three curves is consistent with case 1 in Table IV-2. For a progressive rate structure to emerge as appropriate in case 1, it is necessary to place constraints on the shape of the income-utility function in addition to assuming diminishing marginal utility of income. However, for our evaluative purposes we are interested in the conditions under which tax payments should be positively correlated with income.²³

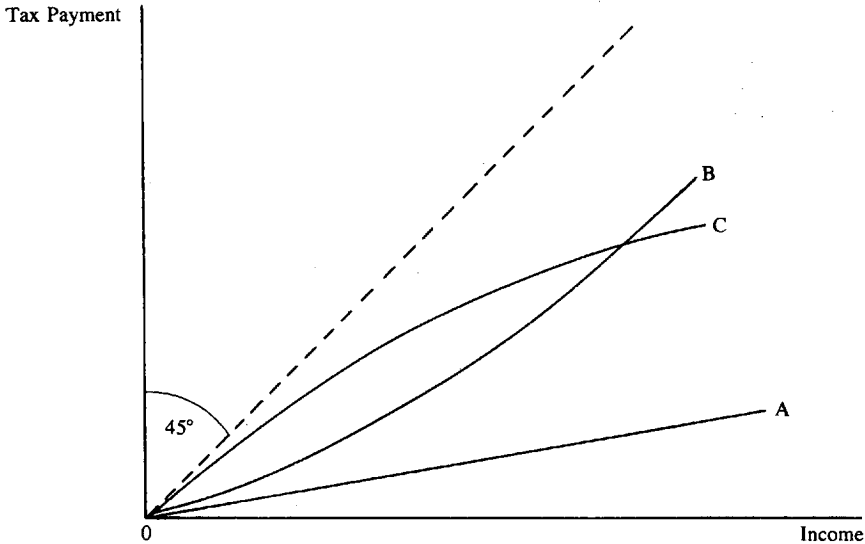
Before moving on it is worthwhile clarifying the ethical and factual assumptions underlying our analysis. The only ethical assumption or value judgment is that the tax burden should be distributed among individuals so that all bear an equal sacrifice in terms of utility lost. For this value judgment to be given operational content, some objective index of an individual's utility must be constructed. If income is used as this objective index, some assumptions of *fact* must be made concerning the relationship between the individual's income and the utility derived from that income. To establish the principle of horizontal equity, i.e. that people in equal economic positions should be treated equally with respect to the amount of tax paid, all that we need to assume is that the income-utility functions of individuals do not exhibit "devious" behaviour and that all individuals have the same income-utility functions.

To establish the proposition that individuals with higher incomes should pay more tax in absolute terms than individuals with lower incomes (a matter of vertical equity), we make the ethical assumption that all individuals should bear an equal sacrifice together with the assumptions

²³ For some original writings on the question of the rate structure, see Pigou, *op. cit.*, Part II, Chapters 4 and 7, and the excerpts from the works of Edgeworth and Cohen-Stuart in Musgrave and Peacock, *op. cit.* More recent expositions can be found in R. A. Musgrave, *The Theory of Public Finance*, *op. cit.*, Chapter 5; H. E. Newman, *An Introduction to Public Finance*, Wiley, New York, 1968, Chapter 8; J. Ochs, *Public Finance*, Harper and Row, New York, 1974, Chapter 5; J. C. Winfrey, *Public Finance*, Harper and Row, New York, 1973, Chapter 2.

Figure IV-3

TAX PAYMENTS AS A FUNCTION OF INCOME



of fact that all individuals have the same income-utility functions and that those functions exhibit diminishing marginal utility of income. It should be emphasised that these assumptions of fact are not sufficient to establish a case in favour of any particular rate structure, i.e. progressive, proportional or regressive. The derivation of an income tax rate structure requires acceptance of a particular concept of equal sacrifice and more stringent constraints on the behaviour of the income-utility function than we have assumed here.²⁴

The factual assumptions underlying this analysis are, unfortunately, untestable. Although various writers have attempted to determine the income-utility relationship from people's insurance decisions and gambling activities, their lack of success has left economists in a position of ignorance on this matter. In the absence of any empirical guidance on the matter of interpersonal comparisons of utility (necessary to compare individual's income-utility functions), we adopt Pigou's position:

"... since it is impossible in practice to take account of variations between different people's capacity for enjoyment, this consideration must be ignored and the assumption made, for want of a better, that temperamentally all taxpayers are alike".²⁵

With regard to the matter of vertical equity, we make the additional rather broad assumption that the marginal utility of income declines as income increases, the rate of decline being irrelevant for our purposes.²⁶

We now return to the problem of the appropriate definition of income to be used as the index of equality.²⁷ The classic statement on this matter is that by Henry Simons, who developed what is referred to as the comprehensive definition of income:

"Personal income may be defined as the algebraic sum of (a) the market value of rights exercised in consumption and (b) the change in the value of the store of property rights between the

²⁴ See Musgrave, *The Theory of Public Finance*, op. cit., pp. 98-102, for a discussion of these constraints.

²⁵ Pigou, op. cit., p. 78.

²⁶ It is possible to avoid making an untestable factual assumption on the matter of interpersonal comparisons of utility if one is prepared to follow Robbins' dictum: "I do not believe, and I never have believed, that in fact men are necessarily equal or should always be judged as such. But I do believe that, in most cases, political calculations which do not treat them as if they were equal are morally revolting." L. Robbins, "Interpersonal Comparisons of Utility: A Comment", *Economic Journal*, Vol. 48, No. 192, December 1938, p. 635. Clearly Robbins regards this matter as a moral imperative.

²⁷ We will not discuss here the debate concerning the use of expenditure as a tax base rather than income or wealth. For a summary discussion see Musgrave, *The Theory of Public Finance*, op. cit., pp. 161-4.

beginning and end of the period in question. In other words, it is merely the result obtained by adding consumption during the period to 'wealth' at the end of the period and then subtracting 'wealth' at the beginning."²⁸

All consumption is included and all additions to and subtractions from wealth are accounted for, regardless of their source or form. Thus transfer payments are included as part of income, as are gambling wins and losses, gifts and bequests. Furthermore, the gains need not be realised — the change in net worth will include all capital gains, realised or not. "All accretion should be included whether it be regular or fluctuating, expected or unexpected, realised or unrealised."²⁹

In reality, the theoretical perfection of this definition cannot be maintained. One of the major problems is that of valuing net worth and changes in net worth. It is here that the distinction between realisation and accretion becomes important. If only realised gains are taxed as income, individuals will have an incentive not to sell their assets and a "locked-in" effect is created. The taxation of gains on accrual is impracticable because of the problem of valuing assets annually.

A further problem with the use of the comprehensive definition of income is the treatment of income in kind. Many people receive services which are not transacted in markets. These range from the consumption of home-grown vegetables to services provided in kind to company executives such as houses and cars. In the words of Pigou:

"it is generally held that only that part of real income which has a money counterpart can be brought into account; to bring in other parts would involve such high administrative costs as not to be worthwhile. In general, therefore, the tax-gatherer has to content himself, for his object of assessment, with money income . . . He leaves outside his net, and so differentiates in favour of, certain forms of real income, not because he wishes to do so, but because he cannot help himself. Thus he neglects the benefit which the owner of a motor-car or yacht, when he uses it himself, obtains from it directly, only including what he obtains from it indirectly when he hires it out for money. He omits also certain parts of real income that some employees receive in kind".³⁰

Another problem is to determine when expenditure is for consumption purposes and when it is an expense incurred in earning income and thus deductible for taxation purposes. My purchase of art materials may be for recreational purposes but a professional artist will purchase such materials in order to earn income. Changes in the price level may also give rise to problems as it is changes in *real* net worth of the individual which are relevant for the comprehensive definition of income.

If the comprehensive definition of income could be applied in practice, an annual wealth tax could not be justified on the ground of horizontal equity. This is because "if all accretions to wealth are taxed under the income tax, any part of a person's net worth, whatever the particular form in which it is held, has been subject to tax at some past date when the accretion occurred".³¹ In such a case, the imposition of a wealth tax is equivalent to a supplementary tax on capital income;³² the principle of horizontal equity is then violated as between recipients of wage income and capital income. It is only when a definition of income is used which is not comprehensive that we can justify the use of a wealth tax on equity grounds.³³ Because the use of comprehensive income as a tax base is the exception rather than the rule, we will proceed to discuss the merits and demerits of a tax on wealth.

The first point to clarify is the meaning of the term "wealth". We will use it to refer to an individual's net worth position — that is, his assets less his liabilities at a point of time. This is

²⁸ Simons, *op. cit.*, p.50.

²⁹ R. A. Musgrave and P. B. Musgrave, *Public Finance in Theory and Practice*, McGraw-Hill, New York, 1973, p.225.

³⁰ *Op. cit.*, p.101.

³¹ Musgrave, *The Theory of Public Finance*, *op. cit.*, p. 175.

³² Suppose an individual holds \$100,000 of wealth in various forms which yield 10 per cent return per annum. The individual then earns \$10,000 per annum income from his capital, so that a 1 per cent wealth tax is equivalent to a 10 per cent tax on capital income. For non-income-earning wealth, the wealth tax represents an income tax on imputed earnings.

³³ A contrary view may be found in L. C. Thurow, "Net Worth Taxes", *National Tax Journal*, Vol. 25, No. 3, September 1972, pp. 417-23.

identical to the usage of the term "net worth" in the comprehensive definition of income. If changes in net worth cannot be captured in the definition of income used as the tax base, then there is an argument for a tax on net worth in order to help achieve horizontal equity. This tax could take the form of either a tax on wealth itself or an income tax on the income earned from wealth. However, the latter would not take into account the imputed income from non-income-earning assets and may be discriminatory in this respect.

The administration of a net worth tax requires individuals to draw up a balance sheet whenever the tax is collected. A major problem here is that of ensuring that all assets have been declared and that the liabilities claimed do exist. Another problem arises with the valuation of assets. We have seen that taxation on an accrual basis requires regular valuations, but if the net worth tax is not imposed until realisation a "locked-in" effect may arise causing an excess burden. Associated with the problem of declaration is the fact that there are a multiplicity of ways in which individuals may hold their assets. If all assets are required to be declared, individuals may hold their wealth in forms which are easily concealable, e.g. jewellery, so that tax evasion is extremely difficult to detect. If only certain types of asset attract the tax, individuals will have an incentive to "wriggle" into holding those assets which do not attract the tax. An excess burden again arises.

Either because of the difficulties of administering a net worth tax or because of a social value judgment that net worth is not relevant to the index of equality, an annual net worth tax has not been used in Australia or the United States. Income, however defined, is usually taken as the index of equality. A justification for this is neatly stated by Gillespie:

"It is necessary, however, to give operational content to the term 'economic position'. In the broadest sense, it can be taken to include the collection of assets which an individual owns: that is, his wealth position. The lack of sufficiently detailed data on individual holdings of all assets, not to mention the dearth of theoretical analysis of taxes in terms of asset position, precludes any empirical investigation along this line. It is usual to rely on current income as a measure of an individual's relative position; and to the extent that current income is an accurate reflection of an individual's asset position, the measure of incidence will approach the measure of 'economic position'."³⁴

Two further problems which arise in determining equal economic positions require a brief discussion. The first of these is the problem of defining the tax-paying unit — between which unit is equality to be sought? This leads to the second problem — tax-paying units with equal income may not have equal abilities-to-pay if they differ in other relevant respects. For example, if the tax-paying unit is the individual, it might be deemed necessary to make an adjustment for the number of dependants a taxpayer is supporting if it is considered that this is a matter relevant to the index of equality. Such an adjustment could be made through a system of tax deductions or tax rebates.

We have now completed our examination of two of the principles which can be used to evaluate various taxes. The first of these, the principle of efficiency or neutrality, tells us that if taxes are not to interfere with the efficiency of resource allocation, they should not distort the choices which individuals will make in deciding how to allocate the resources they have at their disposal. The second principle is that of equity in taxation. In terms of the ability-to-pay approach, this requires the tax burden to be distributed between individuals in such a way that all bear an equal sacrifice. In the last section of this chapter, we demonstrate the relevance of these principles in the context of natural disaster relief for individuals.

(3) Efficiency and Equity in Natural Disaster Relief

If a government has decided to distribute means-tested grants to individuals who have suffered damage as a result of a natural disaster, the principle of efficiency or neutrality requires that such relief be distributed in a way which minimises the excess burden involved. This establishes an *a priori* case in favour of broader bases over narrower bases in the application of a means test.

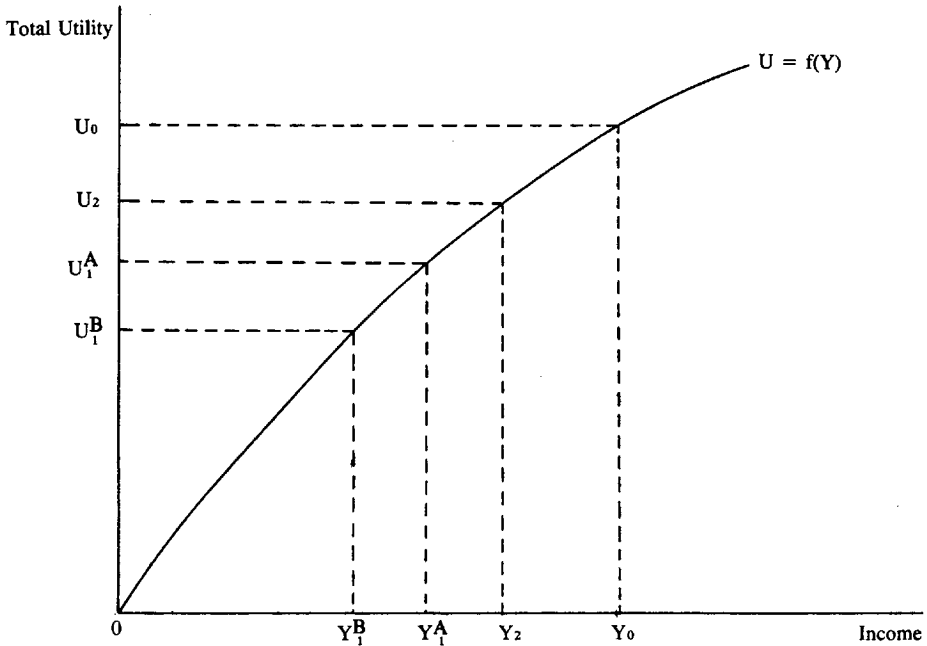
³⁴ W. I. Gillespie, "Effect of Public Expenditures on the Distribution of Income", in R. A. Musgrave (ed.), *Essays in Fiscal Federalism*, The Brookings Institution, Washington D.C., 1965, pp. 124-5.

For example, if the definition of income used is simply wages and salaries, then the means test will create a distortion in the trade-off between this and other forms of income.

The application of the principle of equal sacrifice in taxation to natural disaster relief is a little more complicated and is best illustrated diagrammatically. Figure IV-4 depicts an income-utility function exhibiting diminishing marginal utility of income. In an ideal system, the comprehensive definition of income would be employed. Consider two individuals A and B each of whom has a pre-disaster income of Y_0 . Now suppose they suffer damage as a result of a natural disaster. This damage will be in the form of destruction of assets or loss of income or both. Clearly the absolute magnitudes of these two types of damage cannot be summed, since one is a stock variable and the other a flow variable. However, it is possible to convert the stock variable, involving damage to assets, into a flow variable which we will call the income-equivalent of the value of damage to assets. This conversion may be carried out by means of the present value discounting formula, whereby the value of damage to assets represents the present value of a future income stream.³⁵ The converse procedure may also be undertaken — an income loss may be converted into a value-of-damage-to-assets-equivalent.

Figure IV-4

APPLICATION TO NATURAL DISASTER RELIEF OF AN INCOME-UTILITY FUNCTION WITH DIMINISHING MARGINAL UTILITY OF INCOME



³⁵ Algebraically,

$$D_A = \frac{Y_E^1}{(1+i)} + \frac{Y_E^2}{(1+i)^2} + \dots + \frac{Y_E^n}{(1+i)^n}$$

where D_A = value of damage to assets

Y_E^j = income equivalent in the j th year

i = rate of discount.

It is assumed that $Y_E^1 \dots Y_E^n$ are equal. Solution of the equation will then give the income-equivalent of the damage to assets, Y_E . For a solution to be obtained, values must be specified for n (the number of years) and i (the rate of discount).

It is thus possible to indicate the total value of damage suffered by persons A and B in Figure IV-4 in income-equivalent terms. Let A suffer damage of $(Y_0 - Y_1^A)$ and B suffer damage of $(Y_0 - Y_1^B)$. How should these individuals be treated under the natural disaster relief scheme? It is here that an ethical assumption is required. We postulate initially that an equitable outcome would be one where, *after* distribution of the relief grants, all individuals affected by the disaster had suffered an equal sacrifice as a result of the disaster, measured in utility terms. From our analysis of the previous section we know that, for individuals with equal pre-disaster incomes, this implies that they bear the same income-equivalent of the value of damage themselves, regardless of the concept of sacrifice adopted or the behaviour of the marginal utility of income.³⁶ In terms of Figure IV-4, the relief grants would be such that both A and B would be restored to the same post-disaster income level such as Y_2 . The income-equivalent of the grant to A would then be $(Y_2 - Y_1^A)$ and for B would be $(Y_2 - Y_1^B)$. Both A and B then bear the same income-equivalent of the value of damage themselves, $(Y_0 - Y_2)$.

The treatment of individuals with different pre-disaster income levels is analogous to the taxation treatment discussed in Section (2) of this chapter. If we assume a diminishing marginal utility of income then, regardless of which concept of equal sacrifice is adopted, individuals with higher incomes should bear a higher income-equivalent of the value of damage themselves than individuals with lower incomes.³⁷ This does not establish the "rate structure" in terms of the income-equivalent of the value of damage borne by an individual as a proportion of his income.

A problem with the above analysis must now be clarified. This relates to those individuals who suffer a total income-equivalent of the value of damage which is less than that which individuals on the same or lower incomes have to bear themselves. In terms of Figure IV-4, this would be an individual whose pre-disaster income was Y_0 and whose income-equivalent of the total value of damage was less than $(Y_0 - Y_2)$. Strict application of the equity principle would require the individual to contribute *into* the relief funds until his post-disaster income fell to Y_2 . This would be an absurd situation, for the individual would be subject to a "tax penalty" for having been a victim of the disaster. In view of this consideration, we amend our initial criterion by defining an equitable outcome as one where, after distribution of the relief grants, all individuals suffer *no more than* some particular maximum amount of sacrifice as a result of the disaster and that this maximum is the same for all individuals. In practical terms, this means that individuals with equal incomes should bear *no more than* some specified maximum value of damage themselves and that this maximum should be positively related to income.

An alternative equity criterion posited by Dacy and Kunreuther³⁸ is that a relief program should not make anyone better off in absolute terms after the disaster than before it and that relative welfare positions should not be altered. The latter part of this criterion refers to relative positions among those who suffered damage, because "acceptable disaster relief cannot prevent some backsliding of the injured in relation to the uninjured".³⁹ Thus injured individuals would bear some of the damage themselves. In terms of horizontal equity, this criterion would lead to the same policy conclusion as our criterion, for if individuals with equal pre-disaster incomes are not to have their relative welfare positions affected they must bear the same income-equivalent of the value of damage themselves. The "problem" individuals whose income-equivalent of total damage is less than the income-equivalent of the value of damage borne by other individuals of equal incomes still exist, although this case is not explicitly treated by Dacy and Kunreuther. In terms of vertical equity, restoration of relative welfare (or utility) levels among disaster victims as an objective requires acceptance of equal proportional sacrifice as the relevant concept of equal sacrifice, for application of this concept will result in all individuals affected by the disaster suffering the same proportionate loss of utility, hence leaving their relative welfare positions unaltered. Again allowance must be made for the "problem" individuals.

³⁶ This assumes that such individuals do not differ in other relevant respects such as the number of dependants.

³⁷ The qualification in n. 36 again applies.

³⁸ D. C. Dacy and H. Kunreuther, *The Economics of Natural Disasters*, The Free Press, New York, 1969.

³⁹ *Ibid.*, p. 220.

It should be noted that the Dacy and Kunreuther equity criterion restricts consideration to cases 2, 5 and 8 in our matrix in Table IV-2. If diminishing or constant marginal utility of income is assumed, this equity criterion requires the income-equivalent of the value of damage borne by individuals to increase as their income increases. However, their criterion has no implication for the appropriate "rate structure" in terms of the behaviour of the income-equivalent of damage borne by individuals as a proportion of their income.

Our evaluation of the criteria adopted for distributing relief to individuals after the 1974 flood in Queensland will not require us to express the income-equivalent of the value of damage borne by an individual as a proportion of his income. We can then avoid the income-equivalence calculations and deal directly with the stock magnitudes of damage (D) and grant (G). The variable upon which we will focus our attention is then the value of damage borne by an individual, or (D - G).

In conclusion, it is interesting to note that, in terms of insurance theory the variable (D - G) is actually a deductible. We mentioned in Chapter II, Section (1) that a government, in providing natural disaster relief to the private sector, is acting as an insurer of private sector asset damage. The underlying premise of this chapter has been that the government wishes to pursue a distributional objective in its expenditure for natural disaster relief to individuals. The theory of public finance is then relevant. In terms of the principles of efficiency and equity in taxation, natural disaster relief should be distributed on the basis of what we might call an "equitable deductible" — a deductible which is related to individuals' incomes.⁴⁰ Such a deductible would undoubtedly have implications for the problem of moral hazard. We have not, however, pursued these implications in this chapter, the reason being that they were not considered relevant to an evaluation of the government relief schemes for individuals in Australia. As stated in Chapter II, the Australian Government policy on natural disaster relief to individuals has, in the past, been *ad hoc* and uncertain. It thus seems unlikely that those relief schemes would have given rise to the problem of moral hazard. We thus postpone a consideration of the implications of "equitable deductibles" for the problem of moral hazard until Chapter VI.

⁴⁰ In particular, note that an "equitable deductible" rather than an "equitable co-insurance rate" is what the analysis indicates as being the appropriate basis for distribution. Had an "equitable co-insurance rate" emerged as being appropriate, the ratio (D - G)/D or G/D would be the variable upon which to focus our attention.

V EFFICIENCY AND EQUITY IN THE DISTRIBUTION OF NATURAL DISASTER RELIEF TO INDIVIDUALS — THE QUEENSLAND 1974 FLOODS

During 1973-74, floodwaters in Queensland entered the living areas of 10,922 homes.¹ In Chapter III we looked at the extent to which damage in the Brisbane River catchment, disaggregated by category, was met by insurance, government, philanthropy and the flood victims themselves. In this chapter we are going to consider in detail the criteria used by government to distribute grants to individuals to restore or replace residential assets. We indicate in Table V-1 the absolute and relative proportions of total damage to residential assets that have been met by the three societal mechanisms for spreading the costs of natural disasters and by the flood victims themselves. These data refer only to the Brisbane River valley.

Table V-1

DAMAGE TO RESIDENTIAL ASSETS BORNE BY INSURANCE, GOVERNMENT, CHARITIES AND FLOOD VICTIMS, BRISBANE RIVER VALLEY, 1973-74 FLOOD

Source of Funds	Damage Covered by Each Source \$	% of Total Damage
Insurance	4,395,000	12.2
Philanthropy	4,518,078	12.6
Government — Tax Subsidy	1,327,648	3.7
Government — Grants	15,323,210	42.7
Flood Victims	10,336,064	28.8
Total	35,900,000	100.0

Note: The taxation subsidy referred to in this table relates to the Australian Government subsidy that is given to donors of voluntary appeal funds registered under the *Income Tax Assessment Act 1973*.

Source: Table III-3, Table III-11 and Table III-14.

What is most notable about this table is the relatively small proportion (12.2 per cent) of residential asset damage in the catchment of the Brisbane River that was met by insurance. This is considerably less than the proportion of total damage to all categories that was met by insurance (38 per cent).² The most important single source of funds for repairing damage to residential assets was government, which met in total 46.4 per cent of damage. By far the most significant category of government assistance was grants for the restoration of flooded homes.

Two schemes were operated to give assistance to flood victims. One provided grants for "Personal Distress and Hardship" and the other involved grants for "Housing Repair and Rebuilding". Total Queensland payments under these schemes were \$5,384,509 and \$10,986,442 respectively.³ The schemes were administered by two separate bodies, the Premier's Department in the case of Personal Distress and Hardship grants and the Government Flood Damaged Homes Committee in the case of grants for Housing Repair and Rebuilding.⁴

We shall see shortly that Personal Distress and Hardship grants were administered in such a way as to suggest that such grants were conceived of as proxies for insurance policies on the contents of flooded dwellings, whereas grants for Housing Repair and Rebuilding corresponded to insurance policies on the structure of dwellings. However, the point that we make about these two schemes is that neither was "open-ended", i.e. the purpose of the schemes was not to produce a situation whereby government assistance would ensure that no damage was borne by flood victims. It is clear from Table V-1 that government assistance covered only 46.4 per cent of damage to residential assets. Of the remainder, 28.8 per cent of damage was borne by the flood victims themselves.

¹ Information supplied by Queensland Flood Victims Fund, 1977.

² See Chapter III Section (5).

³ Table III-8.

⁴ For an account of the activities of the Flood Damaged Homes Committee see Chapter III Section (3).

We can view this same phenomenon from a different angle. We know that in total 10,922 homes were flooded in the State.⁵ However, only 6,688 applications were received by the Government Flood Damaged Homes Committee, and only 5,240 of those applications were approved in whole or in part.⁶ The average grant was \$2,351.72.⁷

Clearly, some 4,234 flood victims realised that they were not eligible for government assistance and did not apply, while others who were not eligible applied but were subsequently rejected. In all, 1,448 applications were rejected fully by the Government Flood Damaged Homes Committee.

It was well publicised at the time that assistance under the two government schemes was subject to means tests. Despite the schemes of government assistance to flood victims, we have seen that 28.8 per cent of damage to residential assets was borne by the flood victims themselves. This result was achieved by the operation of means tests which were applied to the schemes for Personal Distress and Hardship and Housing Repair and Rebuilding. In this chapter we are concerned with describing and evaluating those means tests.

(1) A Positive Analysis of the Criteria Adopted

Consider first the grants for Personal Distress and Hardship. The criteria for distribution are detailed in Annexure A to the *Authorization and Determination of the Queensland Flood Relief Act 1974*. Assistance under this type of grant was restricted to food, essential household furnishings, bedding, kitchen and cooking utensils, wearing apparel where replacements were necessary for everyday needs, and the cleaning of a house if the householder was incapacitated.⁸ Maximum limits were placed on claims for damage to particular items. For example, a single person with no dependants could claim no more than \$20 for food or \$20 for household linen. In addition, a limit of \$400 was placed on the total assessable damage for a single person and \$1,200 for a family.

The granting of this type of assistance was subject to *both* an income and a wealth means test. The income means test was operated by specifying an income limit beyond which the grant would be reduced by 3 per cent for each dollar of income in excess of the limit. The income limit varied according to the marital status and number of dependants of the applicant. For a single person, the income means test was not applied until gross weekly income exceeded \$100 per week.⁹ For a married man and wife, the income limit was \$140 per week. For each additional dependant, an extra \$8 per week was added to this limit. In the case of working children living at home, such children were not treated as dependants and, in addition, 25 per cent of the child's weekly income was added to the income of the applicant. The wealth means test was operated by specifying a wealth limit beyond which the grant was reduced by one dollar for each dollar of wealth in excess of the limit. The wealth limit was \$1,000 regardless of marital status or number of dependants. The definition of wealth was not precise. In Annexure A of the *Authorization and Determination*, it is referred to at one point as being composed of "bank balances, investments, and other negotiable assets" and at another point as "bank balances and/or cash investments". From these two statements, it is reasonable to infer that the definition of wealth encompassed only relatively liquid assets such as bank balances, shares, building society deposits and so on. If, however, the applicant possessed any real estate other than an owner-occupied dwelling, he was automatically excluded from assistance. A summary of the income and wealth means tests is given in Table V-2.

With respect to the means tests, an applicant needed to fall into one of four categories. First, his income and wealth could be such that his entitlement was not affected by either of the means tests. Secondly, his economic position could be such that he was subject to the income means test but not the wealth means test. Thirdly, he could be subject to the wealth means test

⁵ Information supplied by Queensland Flood Victims Fund, 1977.

⁶ Government Flood Damaged Homes Committee, *Report*, Brisbane, mimeo., p.5.

⁷ *Ibid.*

⁸ Items not considered essential and hence specifically excluded were dining room suites, television sets, radios, curtains and carpets.

⁹ It is not clear what definition of income was used for this purpose (e.g. whether it was simply gross weekly wage or salary income), although it is known that child endowment allowances were specifically excluded.

Table V-2

SUMMARY OF INCOME AND WEALTH MEANS TESTS — PERSONAL DISTRESS AND HARDSHIP ASSISTANCE

Status of Applicant	Income Limit* (gross weekly income)	Wealth Limit†
Single, no dependants (S)	\$100	\$1,000
Married couple, no dependants (M)	\$140	
Single, one or more dependants (SDe)	\$100 + \$8 per week for each dependant	
Married couple, one or more dependants (MDe)	\$140 + \$8 per week for each dependant	
Single, no dependants, one or more employed children living at home (SZ)	\$100 (25% of each child's income added to the applicant's income)	
Married couple, no dependants, one or more employed children living at home (MZ)	\$140 (25% of each child's income added to the couple's income)	
Single with dependants and one or more employed children living at home (SDeZ)	\$100 + \$8 per week for each dependant (25% of each child's income added to the applicant's income)	
Married couple with dependants and one or more employed children living at home (MDeZ)	\$140 + \$8 per week for each dependant (25% of each child's income added to the couple's income)	

* Grant reduced by 3 per cent for each dollar of income in excess of the limit.

† Grant reduced by one dollar for each dollar of wealth in excess of the limit.

Source: *Authorization and Determination*.

but not the income means test. Fourthly, he could be subject to both means tests. With respect to marital status and dependants, an applicant could fall into one of the eight possible states listed in Table V-2. There were thus 32 different types of applicant who could apply for Personal Distress and Hardship grants. These 32 cases are summarised in Table V-3.

Given this information, it is possible to derive formulae for determining the grant payable in each of the 32 cases. Such formulae for each possible state of the applicant are presented in Tables V-4 to V-11.¹⁰ Consider a single person with no dependants (Table V-4). In case 1 he is subject to neither means test. For damage less than or equal to \$400, he thus receives a grant equal to the estimated damage. Since the maximum grant is \$400, damage of an amount greater than \$400 entitles the individual to a \$400 grant only. In case 2, the income means test applies. If damage is less than \$400, the grant is equal to the damage *less* 3 per cent of such damage for each dollar of income over the limit. If damage exceeds \$400, the grant is then equal to \$400 *less* 3 per cent for each dollar of income over the limit.¹¹ In case 3, the wealth means test applies. In contrast to the income means test, excess wealth is deducted as an *absolute* amount from the grant rather than causing a percentage reduction of the grant. The individual will not receive a grant until the damage exceeds the amount of excess wealth, subject to maximum assessable damage of \$400. For example, suppose the individual's wealth is \$1,300 so that his excess wealth is \$300. He does not become eligible for a grant until his damage exceeds \$300; and the maximum grant he can obtain is \$100 because maximum assessable damage is \$400. We will define the minimum amount of damage which must be incurred in order to qualify for assistance as the "damage threshold". For the case 3 applicant, this threshold is equal to the amount of his excess wealth which, in our example, is \$300.

¹⁰ Note that, in each case the grant (G) must be non-negative — the individual cannot be required to contribute to the scheme.

¹¹ Note that once excess income equals \$33.33 the grant becomes zero, since this amount of excess income leads to a 100 per cent reduction in the grant.

Table V-3

COMBINATIONS OF MARITAL STATUS, NUMBER OF DEPENDANTS, NUMBER OF EMPLOYED CHILDREN LIVING AT HOME AND ECONOMIC POSITION WITH RESPECT TO THE INCOME AND WEALTH MEANS TESTS — PERSONAL DISTRESS AND HARDSHIP ASSISTANCE

	$Y \leq Y_L$ $W \leq 1,000$	$Y > Y_L$ $W \leq 1,000$	$Y \leq Y_L$ $W > 1,000$	$Y > Y_L$ $W > 1,000$
S	1	2	3	4
M	5	6	7	8
SDe	9	10	11	12
MDe	13	14	15	16
SZ	17	18	19	20
MZ	21	22	23	24
SDeZ	25	26	27	28
MDeZ	29	30	31	32

Y_L = income limit relevant to the particular state as per Table V-2

W = wealth (as defined for this purpose)

S = single person

M = married couple

De = dependant(s)

Z = employed child or children living at home

Source: Derived by authors.

Table V-4

FORMULAE FOR DETERMINING GRANTS FOR SINGLE PERSONS WITHOUT DEPENDANTS (S) — PERSONAL DISTRESS AND HARSHIP ASSISTANCE

Case 1	$\left. \begin{array}{l} Y \leq 100 \\ W \leq 1,000 \end{array} \right\} \begin{array}{l} G = D, \\ G = 400, \end{array}$	$\begin{array}{l} D \leq 400 \\ D > 400 \end{array}$
Case 2	$\left. \begin{array}{l} 100 < Y < 133.33 \\ W \leq 1,000 \end{array} \right\} \begin{array}{l} G = D - .03(Y - 100)D, \\ G = 400 - .03(Y - 100)400, \end{array}$	$\begin{array}{l} D \leq 400 \\ D > 400 \end{array}$
Case 3	$\left. \begin{array}{l} Y \leq 100 \\ 1,000 < W < 1,400 \end{array} \right\} \begin{array}{l} G = 0, \\ G = D - (W - 1,000), \\ G = 400 - (W - 1,000), \end{array}$	$\begin{array}{l} D \leq (W - 1,000) \\ (W - 1,000) < D \leq 400 \\ D > 400 \end{array}$
Case 4	$\left. \begin{array}{l} 100 < Y < 133.33 \\ 1,000 < W < 1,400 \end{array} \right\} \begin{array}{l} G = 0, \\ G = D - .03(Y - 100)D - (W - 1,000), \\ G = 400 - .03(Y - 100)400 - (W - 1,000), \end{array}$	$\begin{array}{l} D \leq \frac{(W - 1,000)}{(4 - .03Y)} \\ \frac{(W - 1,000)}{(4 - .03Y)} < D \leq 400 \\ D > 400 \end{array}$

G = grant
D = total damage
Y = gross weekly income
W = wealth (as defined for this purpose)

Source: Derived by authors.

Table V-5

**FORMULAE FOR DETERMINING GRANTS FOR MARRIED COUPLES WITHOUT DEPENDANTS (M) — PERSONAL
DISTRESS AND HARSHIP ASSISTANCE**

<u>Case 5</u>	$\left. \begin{array}{l} Y \leq 140 \\ W \leq 1,000 \end{array} \right\} \begin{array}{l} G = D, \\ G = 1,200, \end{array}$	$\begin{array}{l} D \leq 1,200 \\ D > 1,200 \end{array}$
<u>Case 6</u>	$\left. \begin{array}{l} 140 < Y < 173.33 \\ W \leq 1,000 \end{array} \right\} \begin{array}{l} G = D - .03(Y - 140)D, \\ G = 1,200 - .03(Y - 140)1,200, \end{array}$	$\begin{array}{l} D \leq 1,200 \\ D > 1,200 \end{array}$
<u>Case 7</u>	$\left. \begin{array}{l} Y \leq 140 \\ 1,000 < W < 2,200 \end{array} \right\} \begin{array}{l} G = 0, \\ G = D - (W - 1,000), \\ G = 1,200 - (W - 1,000), \end{array}$	$\begin{array}{l} D \leq (W - 1,000) \\ (W - 1,000) < D \leq 1,200 \\ D > 1,200 \end{array}$
<u>Case 8</u>	$\left. \begin{array}{l} 140 < Y < 173.33 \\ 1,000 < W < 2,200 \end{array} \right\} \begin{array}{l} G = 0, \\ G = D - .03(Y - 140)D - (W - 1,000), \\ G = 1,200 - .03(Y - 140)1,200 - (W - 1,000), \end{array}$	$\begin{array}{l} D \leq \frac{(W - 1,000)}{(5.2 - .03Y)} \\ \frac{(W - 1,000)}{(5.2 - .03Y)} < D \leq 1,200 \\ D > 1,200 \end{array}$

G = grant

D = total damage

Y = gross weekly income of the couple

W = wealth (as defined for this purpose)

Source: Derived by authors.

Table V-6

FORMULAE FOR DETERMINING GRANTS FOR SINGLE PERSONS WITH DEPENDANTS (SDe) — PERSONAL DISTRESS AND HANDSHIP ASSISTANCE

<u>Case 9</u>	$\left. \begin{array}{l} Y \leq 100 + 8N \\ W \leq 1,000 \end{array} \right\}$	$\left. \begin{array}{l} G = D, \\ G = 400, \end{array} \right\}$	$\begin{array}{l} D \leq 400 \\ D > 400 \end{array}$
<u>Case 10</u>	$\left. \begin{array}{l} 100 + 8N < Y < 133.33 + 8N \\ W \leq 1,000 \end{array} \right\}$	$\left. \begin{array}{l} G = D - .03[Y - (100 + 8N)]D, \\ G = 400 - .03[Y - (100 + 8N)]400, \end{array} \right\}$	$\begin{array}{l} D \leq 400 \\ D > 400 \end{array}$
<u>Case 11</u>	$\left. \begin{array}{l} Y \leq 100 + 8N \\ 1,000 < W < 1,400 \end{array} \right\}$	$\left. \begin{array}{l} G = 0, \\ G = D - (W - 1,000), \\ G = 400 - (W - 1,000), \end{array} \right\}$	$\begin{array}{l} D \leq (W - 1,000) \\ (W - 1,000) < D \leq 400 \\ D > 400 \end{array}$
<u>Case 12</u>	$\left. \begin{array}{l} 100 + 8N < Y < 133.33 + 8N \\ 1,000 < W < 1,400 \end{array} \right\}$	$\left. \begin{array}{l} G = 0, \\ G = D - .03[Y - (100 + 8N)]D - (W - 1,000), \\ G = 400 - .03[Y - (100 + 8N)]400 - (W - 1,000), \end{array} \right\}$	$\begin{array}{l} D \leq \frac{(W - 1,000)}{(4 - .03Y + .24N)} < D \leq 400 \\ D > 400 \end{array}$

G = grant
 D = total damage
 Y = gross weekly income
 W = wealth (as defined for this purpose)
 N = number of dependants

Source: Derived by authors.

Table V-7

FORMULAE FOR DETERMINING GRANTS FOR MARRIED COUPLES WITH DEPENDANTS (MDe) — PERSONAL DISTRESS AND HARSHIP ASSISTANCE

<u>Case 13</u>	$\left. \begin{array}{l} Y \leq 140 + 8N \\ W \leq 1,000 \end{array} \right\}$	$\left. \begin{array}{l} G = D, \\ G = 1,200, \end{array} \right\}$	$\begin{array}{l} D \leq 1,200 \\ D > 1,200 \end{array}$
<u>Case 14</u>	$\left. \begin{array}{l} 140 + 8N < Y < 173.33 + 8N \\ W \leq 1,000 \end{array} \right\}$	$\left. \begin{array}{l} G = D - .03[Y - (140 + 8N)] D, \\ G = 1,200 - .03[Y - (140 + 8N)] 1,200, \end{array} \right\}$	$\begin{array}{l} D \leq 1,200 \\ D > 1,200 \end{array}$
<u>Case 15</u>	$\left. \begin{array}{l} Y \leq 140 + 8N \\ 1,000 < W < 2,200 \end{array} \right\}$	$\left. \begin{array}{l} G = 0, \\ G = D - (W - 1,000), \\ G = 1,200 - (W - 1,000), \end{array} \right\}$	$\begin{array}{l} D \leq (W - 1,000) \\ (W - 1,000) < D \leq 1,200 \\ D > 1,200 \end{array}$
<u>Case 16</u>	$\left. \begin{array}{l} 140 + 8N < Y < 173.33 + 8N \\ 1,000 < W < 2,200 \end{array} \right\}$	$\left. \begin{array}{l} G = 0, \\ G = D - .03[Y - (140 + 8N)] D - (W - 1,000), \frac{(W - 1,000)}{(5.2 - .03Y + .24N)} < D \leq 1,200 \\ G = 1,200 - .03[Y - (140 + 8N)] 1,200 - (W - 1,000), \end{array} \right\}$	$\begin{array}{l} D \leq \frac{(W - 1,000)}{(5.2 - .03Y + .24N)} \\ D > 1,200 \end{array}$

G = grant

D = total damage

Y = gross weekly income of the couple

W = wealth (as defined for this purpose)

N = number of dependants

Source: Derived by authors.

Table V-8

FORMULAE FOR DETERMINING GRANTS FOR SINGLE PERSONS WITH EMPLOYED CHILDREN LIVING AT HOME (SZ) — PERSONAL DISTRESS AND HARSHIP ASSISTANCE

Case 17	$Y + .25 \sum_{i=1}^Z Y_i \leq 100$	$\left. \begin{array}{l} G = D, \\ W \leq 1,000 \end{array} \right\} G = 400,$	$D \leq 400$
	$100 < Y + .25 \sum_{i=1}^Z Y_i < 133.33$	$\left. \begin{array}{l} G = D - .03(Y + .25 \sum_{i=1}^Z Y_i - 100)D, \\ W \leq 1,000 \end{array} \right\} G = 400,$	$D > 400$
Case 18	$100 < Y + .25 \sum_{i=1}^Z Y_i < 133.33$	$\left. \begin{array}{l} G = D - .03(Y + .25 \sum_{i=1}^Z Y_i - 100)D, \\ W \leq 1,000 \end{array} \right\} G = 400 - .03(Y + .25 \sum_{i=1}^Z Y_i - 100)400,$	$D \leq 400$
	$1,000 < W < 1,400$	$\left. \begin{array}{l} G = 0, \\ G = D - (W - 1,000), \\ G = 400 - (W - 1,000), \end{array} \right\} (W - 1,000) < D \leq 400$	$D > 400$
Case 19	$Y + .25 \sum_{i=1}^Z Y_i \leq 100$	$G = 0,$	$D \leq (W - 1,000)$
	$100 < Y + .25 \sum_{i=1}^Z Y_i < 133.33$	$\left. \begin{array}{l} G = 0, \\ G = D - .03(Y + .25 \sum_{i=1}^Z Y_i - 100)D - (W - 1,000), \end{array} \right\} (W - 1,000) < D \leq 400$	$D > 400$
Case 20	$100 < Y + .25 \sum_{i=1}^Z Y_i < 133.33$	$\left. \begin{array}{l} G = 0, \\ G = D - .03(Y + .25 \sum_{i=1}^Z Y_i - 100)D - (W - 1,000), \end{array} \right\} (W - 1,000) < D \leq 400$	$D \leq \frac{(W - 1,000)}{(4 - .03Y - .0075 \sum_{i=1}^Z Y_i)}$
	$1,000 < W < 1,400$	$\left. \begin{array}{l} G = D - .03(Y + .25 \sum_{i=1}^Z Y_i - 100)D - (W - 1,000), \\ G = 400 - .03(Y + .25 \sum_{i=1}^Z Y_i - 100)400 - (W - 1,000), \end{array} \right\} (W - 1,000) < D \leq 400$	$D > 400$

G = grant

D = total damage

Y = gross weekly income of parent

 Y_i = gross weekly income of ith employed child living at home

W = wealth (as defined for this purpose)

Z = number of employed children living at home

Source: Derived by authors.

Table V-9
FORMULAE FOR DETERMINING GRANTS FOR MARRIED COUPLES WITH EMPLOYED CHILDREN LIVING AT HOME (MZ) — PERSONAL DISTRESS AND HARSHIP ASSISTANCE

Case 21	$Y + .25 \sum_{i=1}^Z Y_i \leq 140$	$G = D,$	$D \leq 1,200$
Case 22	$140 < Y + .25 \sum_{i=1}^Z Y_i < 173.33$	$G = 1,200 - .03(Y + .25 \sum_{i=1}^Z Y_i - 140)D,$	$D > 1,200$
Case 23	$1,000 < Y + .25 \sum_{i=1}^Z Y_i < 173.33$	$G = 1,200 - .03(Y + .25 \sum_{i=1}^Z Y_i - 140)1,200,$	$D \leq 1,200$
Case 24	$1,000 < Y + .25 \sum_{i=1}^Z Y_i < 173.33$	$G = 1,200 - .03(Y + .25 \sum_{i=1}^Z Y_i - 140)D - (W - 1,000),$	$D \leq 1,200$

G = grant

D = total damage

Y = gross weekly income of the couple

 Y_i = gross weekly income of ith employed child living at home

W = wealth (as defined for this purpose)

Z = number of employed children living at home

Table V-10

FORMULAE FOR DETERMINING GRANTS FOR SINGLE PERSONS WITH DEPENDANTS AND EMPLOYED CHILDREN LIVING AT HOME (SDeZ) — PERSONAL DISTRESS AND HARDSHIP ASSISTANCE

Case 25	$Y + .25 \sum_{i=1}^Z Y_i \leq 100 + 8N$ $W \leq 1,000$	$G = D,$ $G = 400,$	$D \leq 400$ $D > 400$
Case 26	$100 + 8N < Y + .25 \sum_{i=1}^Z Y_i < 133.33 + 8N$ $W \leq 1,000$	$G = D - .03[Y + .25 \sum_{i=1}^Z Y_i - (100 + 8N)] D,$ $G = 400 - .03[Y + .25 \sum_{i=1}^Z Y_i - (100 + 8N)] 400,$	$D \leq 400$ $D > 400$
Case 27	$Y + .25 \sum_{i=1}^Z Y_i \leq 100 + 8N$ $1,000 < W < 1,400$	$G = 0,$ $G = D - (W - 1,000),$ $G = 400 - (W - 1,000),$	$D \leq (W - 1,000)$ $(W - 1,000) < D \leq 400$ $D > 400$
Case 28	$100 + 8N < Y + .25 \sum_{i=1}^Z Y_i < 133.33 + 8N$ $1,000 < W < 1,400$	$G = 0,$ $G = D - .03[Y + .25 \sum_{i=1}^Z Y_i - (100 + 8N)] D - (W - 1,000),$	$D \leq \frac{(W - 1,000)}{Z}$ $(4 - .03Y - .0075 \sum_{i=1}^Z Y_i + .24N)$ $\frac{(W - 1,000)}{Z} < D \leq 400$ $(4 - .03Y - .0075 \sum_{i=1}^Z Y_i + .24N)$

G = grant

D = total damage

Y = gross weekly income of parent

N = number of dependants

Source: Derived by authors.

Y_i = gross weekly income of ith employed child living at home

W = wealth (as defined for this purpose)

N = number of dependants

Z = number of employed children living at home

Table V-11

FORMULAE FOR DETERMINING GRANTS FOR MARRIED COUPLES WITH DEPENDANTS AND EMPLOYED CHILDREN LIVING AT HOME (MDeZ) — PERSONAL DISTRESS AND HARDSHIP ASSISTANCE

<u>Case 29.</u>	$Y + .25 \sum_{i=1}^Z Y_i \leq 140 + 8N$	$G = D,$	$D \leq 1,200$
	$W \leq 1,000$	$G = 1,200,$	$D > 1,200$
<u>Case 30</u>	$140 + 8N < Y + .25 \sum_{i=1}^Z Y_i < 173.33 + 8N$	$G = D - .03[Y + .25 \sum_{i=1}^Z Y_i - (140 + 8N)] D,$	$D \leq 1,200$
	$W \leq 1,000$	$G = 1,200 - .03[Y + .25 \sum_{i=1}^Z Y_i - (140 + 8N)] 1,200,$	$D > 1,200$
<u>Case 31</u>	$Y + .25 \sum_{i=1}^Z Y_i \leq 140 + 8N$	$G = 0,$	$D \leq (W - 1,000)$
	$1,000 < W < 2,200$	$G = D - (W - 1,000),$	$(W - 1,000) < D \leq 1,200$
		$G = 1,200 - (W - 1,000),$	$D > 1,200$
<u>Case 32</u>	$140 + 8N < Y + .25 \sum_{i=1}^Z Y_i < 173.33 + 8N$	$G = 0,$	$D \leq \frac{(W - 1,000)}{Z} (5.2 - .03Y - .0075 \sum_{i=1}^Z Y_i + .24N)$
	$1,000 < W < 2,200$	$G = D - .03[Y + .25 \sum_{i=1}^Z Y_i - (140 + 8N)] D - (W - 1,000),$	$\frac{(W - 1,000)}{Z} < D \leq 1,200$
			$(5.2 - .03Y - .0075 \sum_{i=1}^Z Y_i + .24N)$

$$G = 1,200 - .03[Y + .25 \sum_{i=1}^Z Y_i - (140 + 8N)] 1,200 - (W - 1,000),$$

G = grant

D = total damage

Y = gross weekly income of the couple

N = number of dependants

Z = number of employed children living at home

Y_i = gross weekly income of ith employed child living at home
 W = wealth (as defined for this purpose)

 $D > 1,200$

In case 4, both the income and the wealth means tests apply. The grant is then abated by 3 per cent for each dollar of excess income and by one dollar for each dollar of excess wealth. The maximum assessable damage remains at \$400. However, the damage threshold in this case exceeds the amount of excess wealth. This is so because the damage threshold must be such that, after abatement for excess income, it is equal to the amount of excess wealth. For example, suppose we have an individual in the following position:

$$\begin{array}{ll} Y = \$110 & \text{Excess } Y = \$10 \\ W = \$1,100 & \text{Excess } W = \$100 \end{array}$$

The damage threshold will be approximately \$143 which, after an abatement of 30 per cent for excess income, will be equal to the amount of excess wealth.¹²

From the foregoing discussion it can be seen that the grant was calculated in such a way that all damage in excess of a defined limit was irrelevant for the purpose of determining the grant. Alternatively, we may say that the abatements for excess income or wealth were applied to a maximum assessable damage and not to the total value of damage where total damage exceeded the maximum assessable. This point is best clarified by means of an example. Consider a case 3 individual who had \$2,500 wealth and had incurred \$2,000 damage. His excess wealth was then \$1,500. If the wealth means test had been applied in such a way as to result in an abatement of the total damage, the adjusted total damage would have been \$500. Because the maximum grant was \$400, the individual would then have received \$400. Under this interpretation, the grant would have been calculated as the difference between excess wealth and total damage, subject to a maximum grant of \$400. However, this was *not* the way the scheme was operated. Determination of the grant was by means of the following two-stage procedure. First, the grant was set equal to damage subject to a maximum assessable damage of \$400 (or \$1,200 for a family). Secondly, the grant was then abated in accordance with the means tests described above. Thus the actual operation of the scheme was subject to a more binding constraint than an upper limit on the amount of the grant. This more binding constraint was an upper limit on the amount of assessable damage, so that the means tests resulted in an abatement of the grant and not of the total damage.

It is necessary to clarify further what is meant by the statement that a constraint on the amount of assessable damage is more binding than a constraint on the maximum amount of the grant. It is more binding in the following respects: first, it reduces the number of individuals who qualify for a grant as compared with a constraint simply on the maximum amount of the grant; and secondly, for those who do qualify but are subject to a means test and whose damage exceeds the maximum assessable amount, the grant is less than it would be if the constraint were simply on the maximum amount of the grant. Each of these propositions will be demonstrated in turn. For illustrative purposes, we will confine our attention to single persons with no dependants.

The first proposition applies only to a subset of those individuals excluded by excess wealth. For those subject only to the income means test, the type of constraint makes no difference as to who is included or excluded since an excess income of \$33.33 or more will result in a 100 per cent reduction of the grant under either constraint. With reference to the wealth means test, under the more binding constraint on maximum assessable damage anyone with excess wealth greater than \$400 (or total wealth greater than \$1,400) cannot receive assistance regardless of the level of damage. This applies to both cases 3 and 4. Dealing first with case 3, Chart V-1 shows the value of the grant as a function of wealth. For damage equal to or greater than \$400,

¹² Mathematically, taking the grant formula for case 4 for $D \leq 400$ from Table V-4,

$$\begin{aligned} G &= D - 0.3(Y-100)D - (W-1,000) \\ &= D(4-.03Y) - (W-1,000) \end{aligned}$$

$$\text{Now} \quad G = 0 \Rightarrow D = \frac{(W-1,000)}{(4-.03Y)}$$

$$\text{But} \quad 0 < 4-.03Y < 1 \text{ for } 100 < Y < 133.33$$

$$\text{Therefore} \quad G = 0 \Rightarrow D > (W-1,000)$$

An analogous result can be obtained for all other cases where both means tests are applicable.

the grant is \$400 for wealth of \$1,000 or less. The grant then declines on a dollar-for-dollar basis as wealth increases beyond \$1,000, the grant falling to zero when wealth equals \$1,400. The grant curve is thus ABC.¹³

Now suppose the constraint were simply that the grant could not exceed \$400 and the damage actually incurred was \$1,000. In this case, a grant of \$400 would be paid until wealth exceeded \$1,600. For wealth in excess of \$1,600, the grant would decline on a dollar-for-dollar basis with excess wealth until wealth reached \$2,000, at which point the grant would be zero. The grant curve would then be AEF in Chart V-1. In this particular example, an individual with total wealth of \$1,600 would receive the maximum grant whereas he would be excluded under the constraint on maximum assessable damage.

The reason for this can be clarified by considering the formula for determining the grant if the constraint were that the grant could not exceed \$400, namely

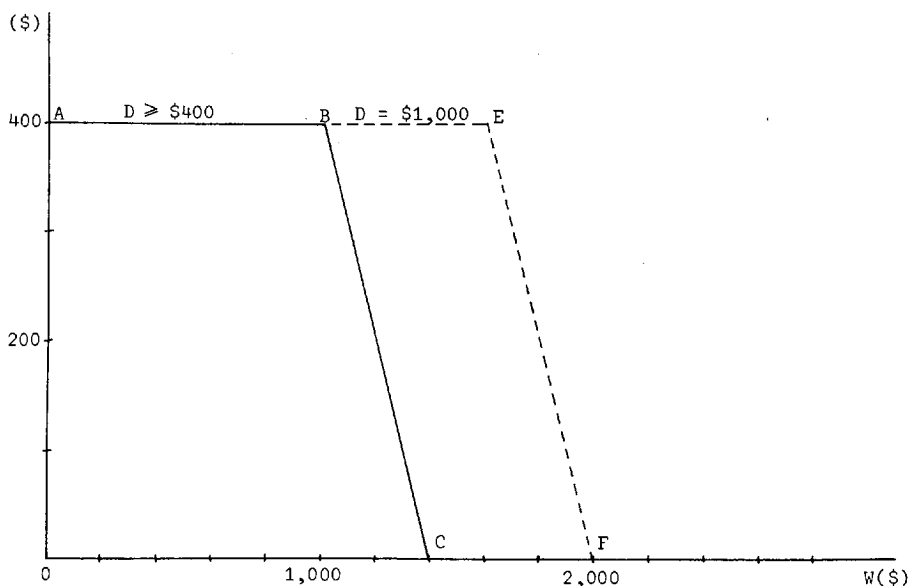
$$G = D - (W - 1,000), \quad 0 \leq G \leq 400.$$

The constraint only applies to the *difference* between damage and excess wealth, whereas the formula under the more binding constraint (Case 3, Table V-4) applies to the *absolute amount* of assessable damage.

It is evident that, where damage is less than \$400, the same individuals will be excluded under either constraint simply because with such damage levels neither constraint is binding. The same level of excess wealth will exclude the individual under either system. For example, if $D = \$300$, excess wealth of \$300 will exclude this person regardless of whether maximum assessable damage is \$400 or the maximum grant is \$400.¹⁴

Chart V-1

VALUE OF GRANT AS A FUNCTION OF WEALTH — CASE 3, PERSONAL DISTRESS AND HARDSHIP ASSISTANCE



G = grant

W = wealth (as defined)

D = damage

¹³ A grant curve for $D < \$400$ has not been included because, as will be seen shortly, the wealth means test makes no difference as to who is included or excluded in such a case.

¹⁴ It should also be noted that, for a case 1 applicant, a constraint on maximum assessable damage is equivalent to a constraint on the maximum grant.

Turning now to a case 4 applicant, the value of the grant as a function of wealth is depicted in Chart V-2. This is a more complex case and, in order to obtain a graph, we must specify some particular income level within the relevant limits. For our example, we will take $Y = \$110$. It will also simplify matters if we specify some particular damage level, say $D = \$700$. Now for wealth less than or equal to \$1,000, the applicant is subject to the income means test only. The grant, over this range of wealth, is then

$$G = 400 - .03(110-100)400, \quad D = 700 \\ = 280$$

with the constraint on maximum assessable damage. For wealth in excess of \$1,000,

$$G = 400 - .03(110-100)400 - (W-1,000) \\ = 280 - (W-1,000) \\ = 1,280 - W.$$

The grant falls to zero when wealth reaches \$1,280. The grant curve is thus BCE in Chart V-2.

Now suppose the constraint were simply on the maximum amount of the grant. For wealth less than or equal to \$1,000,

$$G = D - .03(Y-100)D, \quad 0 \leq G \leq 400.$$

For damage of \$700 and income of \$110, the grant would then be \$400.

For wealth in excess of \$1,000,

$$G = D - .03(Y-100)D - (W-1,000), \quad 0 \leq G \leq 400.$$

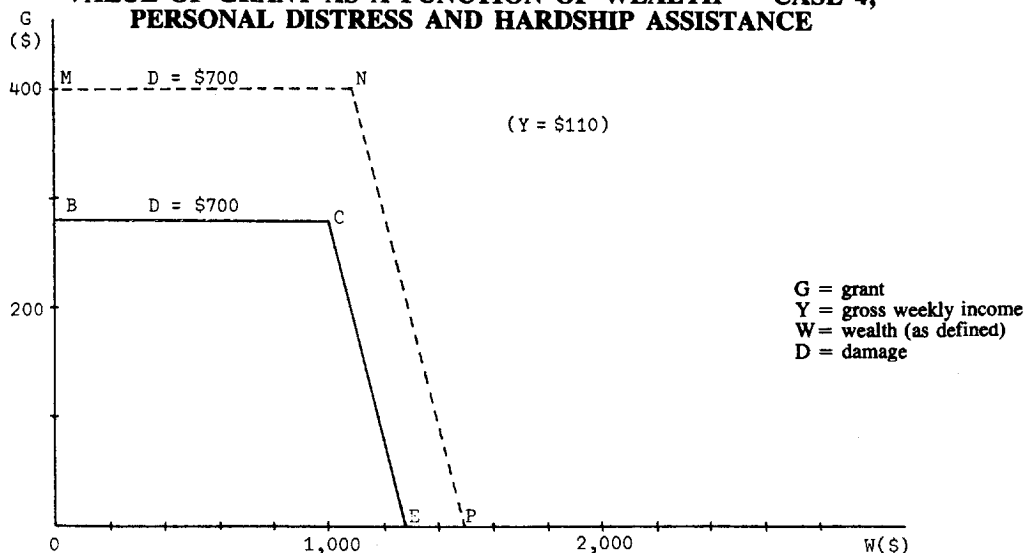
Inserting $D = \$700$ and $Y = \$110$,

$$G = 700 - 210 - (W-1,000) \\ = 490 - (W-1,000) \\ = 1,490 - W.$$

The grant now falls to zero when wealth reaches \$1,490. Furthermore, the maximum grant of \$400 would be obtained until wealth exceeded \$1,090 because it is only for levels of wealth in excess of this amount that the grant is reduced below the upper limit of \$400. For example, if wealth were \$1,050, the grant would be the maximum amount of \$400. The grant curve with the constraint on the maximum grant is shown as the dashed line MNP in Chart V-2. Now if this particular applicant's wealth were \$1,400, he would be excluded from assistance under the constraint on maximum assessable damage but would receive assistance with a constraint on the maximum grant.

Chart V-2

**VALUE OF GRANT AS A FUNCTION OF WEALTH — CASE 4,
PERSONAL DISTRESS AND HARDSHIP ASSISTANCE**



We may now summarise the first proposition. A constraint on maximum assessable damage is more binding than a constraint on the maximum grant in that some individuals whose damage exceeds the maximum assessable would be excluded from assistance under the former constraint but would receive assistance under the latter constraint.

The second proposition concerns those people who qualify for assistance under the more binding constraint, who are subject to the operation of either or both means tests and whose damage exceeds the maximum assessable. Such people will receive a smaller grant than they would have if the constraint was only on the maximum amount of the grant. This proposition is most easily demonstrated with a set of diagrams.

Consider first the operation of the income means test where the constraint is on the maximum assessable damage. In Chart V-3 damage (D) is measured on the horizontal axis and the grant (G) on the vertical axis. The graphs can be derived directly from the formulae for cases 1 and 2 in Table V-4. The graph labelled "Case 1" is self-explanatory. For $D \leq \$400$, $G = D$ and for $D > \$400$, $G = \$400$. The case 2 individual with some given income level $Y = Y_1$ is subject to the income means test. For $D \leq \$400$, G is a constant fraction of D , the value of this fraction depending upon the amount of excess income. For $D > \$400$, the grant then remains constant.¹⁵

Now suppose the less binding constraint were introduced, namely that the grant cannot exceed \$400. The case 1 individual will be unaffected.¹⁶ The case 2 individual, however, may be affected. The formula for determining the grant would now be

$$G = D - .03(Y-100)D, \quad 0 \leq G \leq 400.$$

Thus the grant would remain a constant proportion of the damage until the absolute value of the damage reached the level at which the grant became \$400. The value of the grant would then be invariant with respect to any further damage. In terms of Chart V-3, if we again consider the individual with $Y = Y_1$, for $D > \$400$ he moves along the dashed line with the grant increasing as damage increases to a maximum grant of \$400. For $D \leq \$400$, he receives the same grant under either constraint.

Now consider the operation of the wealth means test where the constraint is on the maximum assessable damage. Chart V-4 has the same axes as Chart V-3 and again our attention is confined to the single person with no dependants. The graphs are derived directly from the formulae for cases 1 and 3 in Table V-4. The graph for the case 1 individual is identical to that in Chart V-3. The case 3 individual is subject to the wealth means test. For the given wealth level W_1 , the damage threshold is positive — he will receive no grant until damage exceeds the value of excess wealth. Once total damage exceeds the damage threshold, he receives a dollar-for-dollar grant on damage in excess of the threshold until total damage reaches \$400. Thereafter, the grant remains constant.¹⁷

Now suppose we introduce the less binding constraint that the maximum grant is \$400. The formula for determining the grant would then be

$$G = D - (W-1,000), \quad 0 \leq G \leq 400.$$

¹⁵ The behaviour of the graph for case 2 can be derived mathematically from the formulae for case 2 in Table V-4:

$$\frac{dG}{dD} = 1 - .03(Y-100), \quad D \leq 400 \quad (0 < \frac{dG}{dD} < 1 \text{ for } 100 < Y < 133.33).$$

$$\frac{dG}{dD} = 0, \quad D > 400. \quad (\text{The grant is invariant with respect to damage.})$$

¹⁶ The formula for determining such a grant would become

$$G = D, \quad G \leq 400$$

which gives the same graph as in Chart V-1.

¹⁷ Mathematically,

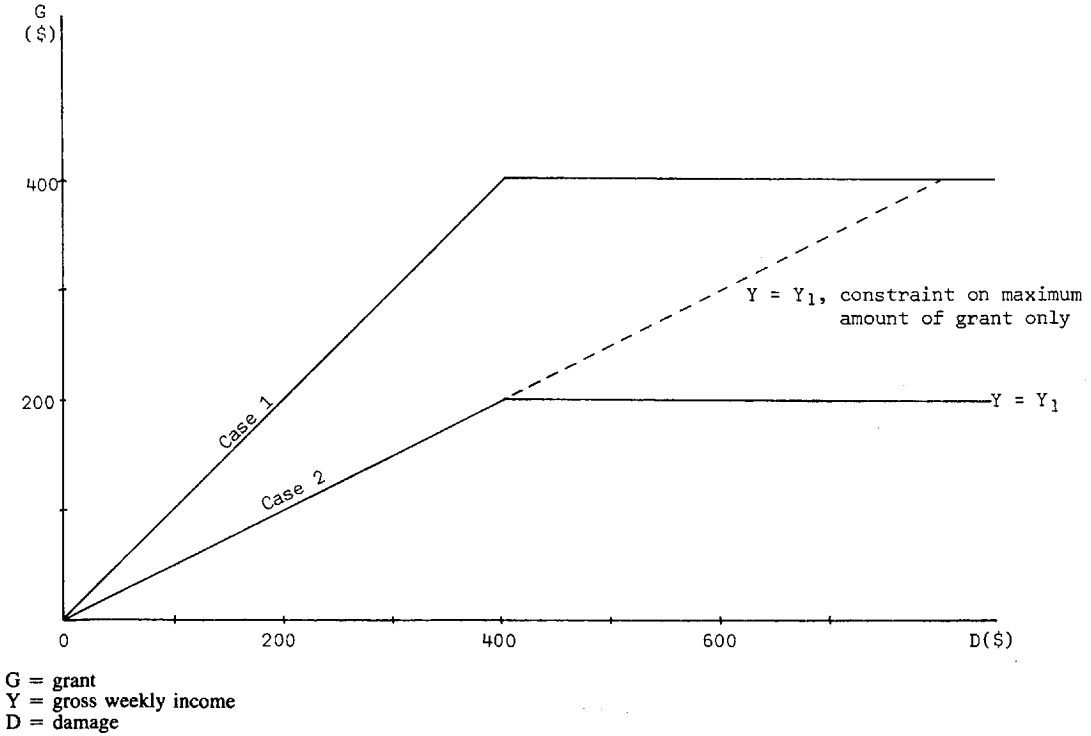
$$\frac{dG}{dD} = 0, \quad D \leq (W-1,000)$$

$$\frac{dG}{dD} = 1, \quad (W-1,000) < D \leq 400$$

$$\frac{dG}{dD} = 0, \quad D > 400$$

Chart V-3

VALUE OF GRANT AS A FUNCTION OF DAMAGE — CASES 1 AND 2, PERSONAL DISTRESS AND HARDSHIP ASSISTANCE



With the given level of wealth W_1 , the damage threshold would remain the same. But as damage increased beyond \$400, the grant would continue to increase until it reached a maximum of \$400; the individual would move along the dashed line in Chart V-4. Note that for $D \leq 400$, the grant remains the same under either constraint.

Finally, consider the operation of the income and wealth means tests combined. For the single individual with no dependants, the situation is depicted in Chart V-5. With given income and wealth levels Y_1 and W_1 respectively, the damage threshold is positive and is given by the following formula:¹⁸

$$D_t = \frac{(W - 1,000)}{(4 - .03Y)} \quad (D_t = \text{damage threshold})$$

When total damage exceeds the damage threshold, the individual becomes entitled to a grant. The grant increases until total damage reaches \$400, at which point the grant becomes constant.¹⁹ The

¹⁸ See n. 12.

¹⁹ Mathematically,

$$\begin{aligned} \frac{dG}{dD} &= 0, & D &\leq \frac{(W - 1,000)}{(4 - .03Y)} \\ \frac{dG}{dD} &= 1 - .03(Y - 100), & \frac{(W - 1,000)}{(4 - .03Y)} < D \leq 400 \end{aligned}$$

(Note that $0 < \frac{dG}{dD} < 1$ for $100 < Y < 133.33$)

$$\frac{dG}{dD} = 0, \quad D > 400.$$

Chart V-4

VALUE OF GRANT AS A FUNCTION OF DAMAGE — CASES 1 AND 3, PERSONAL DISTRESS AND HARDSHIP ASSISTANCE

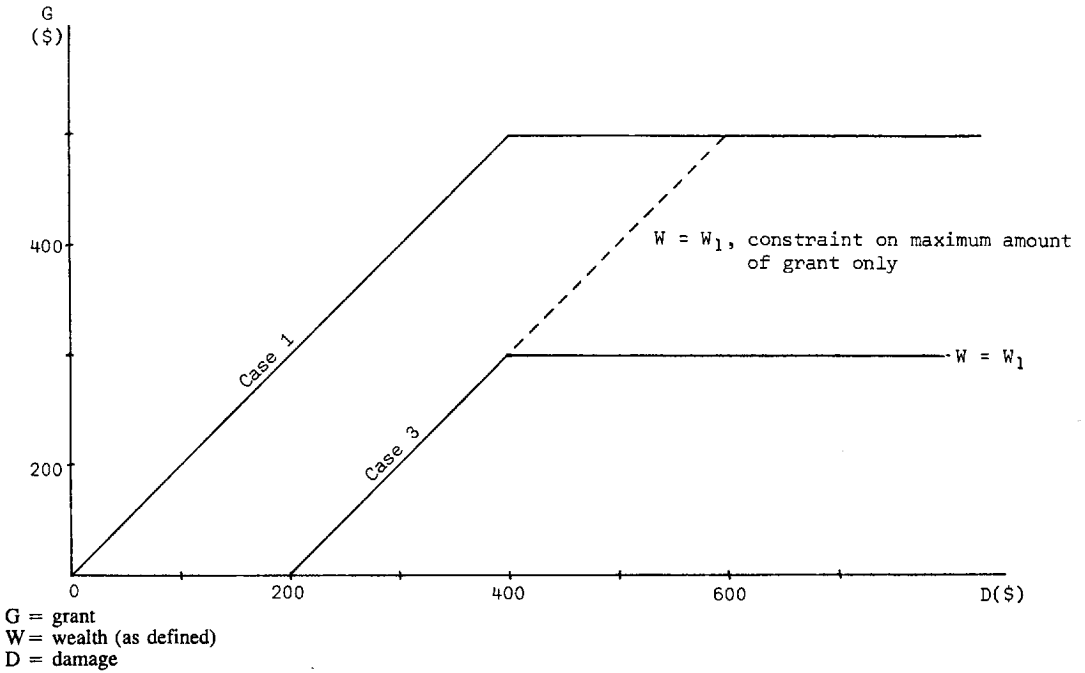
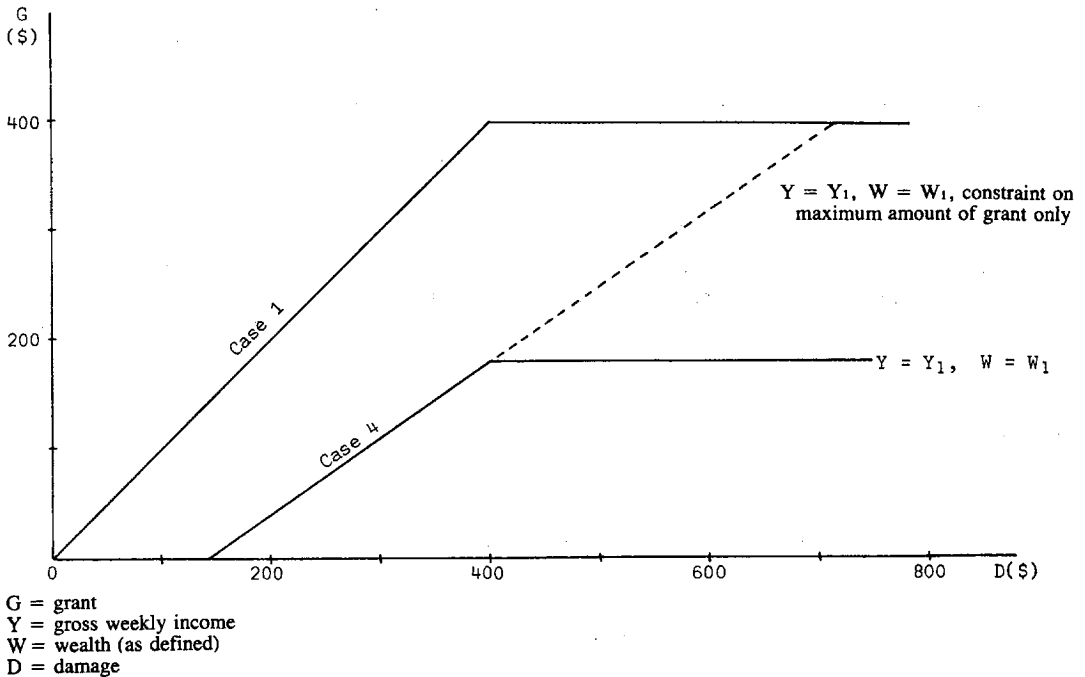


Chart V-5

VALUE OF GRANT AS A FUNCTION OF DAMAGE — CASES 1 AND 4, PERSONAL DISTRESS AND HARDSHIP ASSISTANCE



maximum grant can be calculated from the formulae for the case 4 applicant for $D > \$400$ in Table V-4. In simplified form, this formula becomes

$$G = 400(4 - .03Y) - (W - 1,000)$$

which always gives a grant of less than \$400 for relevant values of income and wealth.

Under the less binding constraint that the maximum grant be \$400, the formula for determining the grant would be

$$G = D - .03(Y - 100)D - (W - 1,000), \quad 0 \leq G \leq 400.$$

There would then be scope for the grant to increase to \$400 as damage increased. In terms of Chart V-5, the applicant would move along the dashed line as damage increased beyond \$400. When the upper limit of the grant was reached (i.e. \$400), the grant would become invariant with respect to further damage.

The foregoing analysis can be applied in an analogous fashion to the other types of applicant as listed in Table V-2. The graphs would take on corresponding shapes to those in Charts V-1 to V-5, although the maximum assessable damage and the income limits for the income means test would vary as between the different types of applicant. It is thus clear that the constraint on the amount of assessable damage is more binding than a constraint in terms of the maximum grant obtainable.

The criteria used for distributing this type of relief actually embodied a constraint on the amount of flood damage assessable for the purpose of determining the grant. In particular, we have shown that, as compared with a constraint on the amount of the grant only, the constraint on assessable damage excluded a larger number of people from assistance and resulted in smaller grants for those subject to either or both means tests and whose damage exceeded the maximum assessable. The former conclusion was demonstrated in Charts V-1 and V-2, while the latter conclusion was demonstrated in Charts V-3 to V-5. This analysis was conducted in terms of a single applicant with no dependants, although the propositions hold for the remaining types of applicant.

We now turn to an analysis of the second type of government assistance to individuals who incurred damage — the grants for Repairs and Rebuilding of Private Residences. The criteria for distribution of this type of assistance are detailed in Annexure C of the *Authorization and Determination*. The grants were divided into three categories:

- Category A — Emergency repairs in cases of personal distress and hardship: designed to cover the cost of essential repairs to make the home habitable and secure, initially; such grants were not to include repairs of a long-term nature, i.e. grants not essential in making the home habitable.
- Category B — Repairs and rebuilding of private residences: for rebuilding or purchase of a substitute residence on approved sites where the private residence has been destroyed or damaged beyond economic repair, or for repairs to restore the dwelling to its previous standard.²⁰
- Category C — Removal of private residences to other locations: for the removal of a dwelling to new approved location either as a result of damage by the disaster to the land on which the dwelling is erected or where the dwelling has been seriously damaged or inundated in an area likely to be subject to excessive flooding in the future.²¹

Since no Category A grants were ever made, we shall confine our attention to the criteria used for distributing Category B and Category C grants.

²⁰ Those applicants who qualified for a grant under this Category, but who required additional finance to restore their home up to its original standard and could not obtain such finance from other sources of housing finance, had access to additional assistance by way of *loan* from the Queensland Housing Commission to a maximum of \$10,000 for the home and \$5,000 for the net cost of approved substitute land where applicable. Since this assistance was by way of a loan and not a grant, we will not be concerned with it in this analysis of grant relief.

²¹ There is an ambiguity in the *Authorization and Determination* with respect to grants for this purpose. Annexure D provides for "Grants for Houses Damaged or Threatened by Landslip or Erosion" and appears to provide assistance for the same type of damage as do Annexure C, Category C grants. The only substantive difference between the two is that Annexure D allows for a maximum grant of \$4,000 for removal costs whereas Annexure C, Category C grants allow a \$2,000 maximum. We were informed by the Secretary of the Queensland Flood Damaged Homes Committee that, in the early stages of the distribution of Housing Repair and Rebuilding grants, it was realised that a \$2,000 maximum grant for removal costs was too stringent and the limit was raised to \$4,000. It appears that the purpose of inserting Annexure D may have been simply to increase the maximum grant for removal costs to \$4,000.

The criteria used for distribution of Category B and Category C grants were identical, except for one relatively minor difference which will be mentioned below. To be eligible for a grant, a person needed to own and occupy the dwelling. Thus a flooded dwelling occupied by a tenant was not capable of attracting a grant for damage incurred. An application either from the tenant or the landlord would not have been approved. However, a tenant could apply for a grant under the Personal Distress and Hardship Assistance scheme. If damage to a dwelling was covered by insurance, no grant was given although consideration was given where the insurance cover was inadequate. The amount of the grant was the net cost of rebuilding, or substitute purchase, or the net cost of repairs up to a maximum total grant of \$15,000. In the case of Category C grants, an extra constraint was that, of the \$15,000, no more than \$4,000 was to be for removal costs.²² The amount of the grant as determined was then abated by one dollar for each dollar by which the applicant's net realisable assets exceeded \$10,000, that is a wealth means test was employed. The definition of net realisable assets was not precise. The value of the applicant's (owner-occupied) dwelling and the land on which it was situated were *excluded*, together with the associated mortgage, if any, in calculating net realisable assets. Cars and boats (and associated mortgages) were also specifically excluded. Items such as bank balances, building society deposits, shareholdings and bonds were included. The use of the term "realisable assets" would imply that only relatively liquid assets were included.

Table V-12

FORMULAE FOR DETERMINING HOUSING REPAIR AND REBUILDING GRANTS

Class 1 Applicant	(NRA ≤ \$10,000)		
	G = D,		D ≤ 15,000
	G = 15,000,		D > 15,000
Class 2 Applicant	(\$10,000 < NRA < \$25,000)		
	G = 0,		D ≤ (NRA - 10,000)
	G = D - (NRA - 10,000),	(NRA - 10,000) < D	< 15,000
	G = 15,000 - (NRA - 10,000),		D > 15,000

NRA = net realisable assets

G = grant

D = damage

Source: Derived by authors.

The operation of this scheme thus divided applicants into two classes. A Class 1 applicant had net realisable assets less than or equal to \$10,000 while a Class 2 applicant had net realisable assets exceeding \$10,000. The formulae for determining the grant for each class of applicant are given in Table V-12. For the Class 1 applicant (not subject to the wealth means test), the grant equalled damage up to damage of \$15,000. For damage in excess of \$15,000, the grant remained constant at \$15,000. For the Class 2 applicant (subject to the wealth means test), the grant equalled the damage less the amount of excess net realisable assets for damage up to and including \$15,000. For damage in excess of this amount, the grant was equal to \$15,000 *less* the amount of excess net realisable assets. For example, suppose individuals A and B both had net realisable assets of \$18,000 while A had damage of \$10,000 and B had damage of \$20,000. We can summarise this example as follows:

Individuals	Net Realisable Assets (NRA)	Damage (D)	Grant (G)
A	\$18,000	\$10,000	\$2,000
B	\$18,000	\$20,000	\$7,000

²² As mentioned in n.21, the *Authorization and Determination* actually specified a maximum of \$2,000 for Annexure C, Category C grants but the Annexure D maximum of \$4,000 was operative. Also, the *Authorization and Determination* specified that, where homes were to be replaced, a maximum of \$13,700 would be allowed for a two-bedroom house in the metropolitan area plus a loading for additional construction costs in non-metropolitan areas up to a maximum of \$15,000. For houses with more than two bedrooms, the maximum was \$15,000 for all areas. However, this distinction was not applied by the Queensland Flood Damaged Homes Committee in the operation of the scheme.

Both individuals then had excess net realisable assets of \$8,000. A's grant was \$2,000 (= \$10,000 - \$8,000) while B's grant was \$7,000 (= \$15,000 - \$8,000). This example helps to clarify three points about a Class 2 applicant. First, he received a grant only if his damage exceeded the amount of his excess net realisable assets; his damage threshold was equal to the amount of his excess net realisable assets (\$8,000 in this example). Secondly, once net realisable assets were equal to or greater than \$25,000, no grant was obtainable regardless of damage. Thirdly, the *maximum* grant any such applicant *could* obtain was equal to the difference between his excess net realisable assets and the maximum assessable damage of \$15,000 (since damage in excess of \$15,000 was not assessable). For individuals A and B, this was \$7,000.²³

It is clear from the foregoing discussion that the wealth means test applied to this type of assistance was analogous to the wealth means test used in the Personal Distress and Hardship scheme. In particular, this means test operated as an abatement of the *grant* and not the *damage*. The constraint was on the maximum assessable damage rather than the maximum grant. Had the constraint been on the latter, the formula for determining the grant for the Class 2 applicant would have been

$$G = D - (\text{NRA} - 10,000), \quad G \leq 15,000.$$

This may be compared with the formulae under the more binding constraint on maximum assessable damage (see Table V-12). If the constraint were simply on the amount of the grant, it would be constraining only the *difference* between damage and excess net realisable assets rather than the *absolute amount* of assessable damage.

The constraint on maximum assessable damage is more binding in two respects. First, it excludes some people from assistance who may have qualified under a constraint only on the maximum amount of the grant. Secondly, for those who do qualify, who have excess net realisable assets and whose damage exceeds \$15,000, the grant is smaller than it would have been had the constraint been on the maximum amount of the grant only.

The graphs in Chart V-6 depict the grant as a function of net realisable assets under each constraint. The grant curve ABC applies when the constraint is on maximum assessable damage and applies to damage levels equal to or greater than \$15,000. The abatement of the grant begins when net realisable assets exceed \$10,000, and the grant declines to zero when net realisable assets equal \$25,000. Now suppose that the constraint was on the maximum amount of the grant and that the damage was \$22,000. A grant of \$15,000 would be paid until net realisable assets reached \$17,000. For net realisable assets equal to or less than this amount, the *difference* between damage and excess net realisable assets would be greater than \$15,000. For net realisable assets in excess of \$17,000, the grant would decline on a dollar-for-dollar basis reaching zero when net realisable assets totalled \$32,000. This is depicted by the grant curve AEF in Chart V-6.

For damage levels equal to or less than \$15,000, there is no difference between the constraints in terms of the individuals included because neither constraint will be binding for such damage levels. Also, the two different constraints are equivalent for those individuals not subject to the means test, because they both lead to a maximum grant of \$15,000. The first proposition may now be summarised. A constraint on maximum assessable damage is more binding than a constraint on the maximum grant in that some individuals whose damage exceeds the maximum assessable and who are subject to the wealth means test would have received assistance under the latter constraint but will be excluded from assistance under the former constraint.

In order to demonstrate the second proposition, consider Chart V-7 which depicts the grant on the vertical axis and damage on the horizontal axis. The graph for the Class 1 applicant is self-explanatory. The grant increases dollar-for-dollar with damage until damage reaches \$15,000. Thereafter the grant remains at \$15,000. In this case, the two constraints are equivalent. The particular Class 2 applicant whose position is depicted in Chart V-7 has net realisable assets of \$18,000. His damage threshold is \$8,000 and, with maximum assessable damage set at \$15,000, his maximum grant is \$7,000. Now if the constraint had been that the grant could not exceed \$15,000, the Class 2 applicant's grant would have continued to increase as his damage exceeded \$15,000, to a maximum grant of \$15,000; this is indicated by the dashed lined in Chart V-7. We

²³ Only B *actually* obtained the maximum possible grant since his damage exceeded \$15,000.

Chart V-6

VALUE OF GRANT AS A FUNCTION OF NET REALISABLE ASSETS — HOUSING REPAIR AND REBUILDING ASSISTANCE

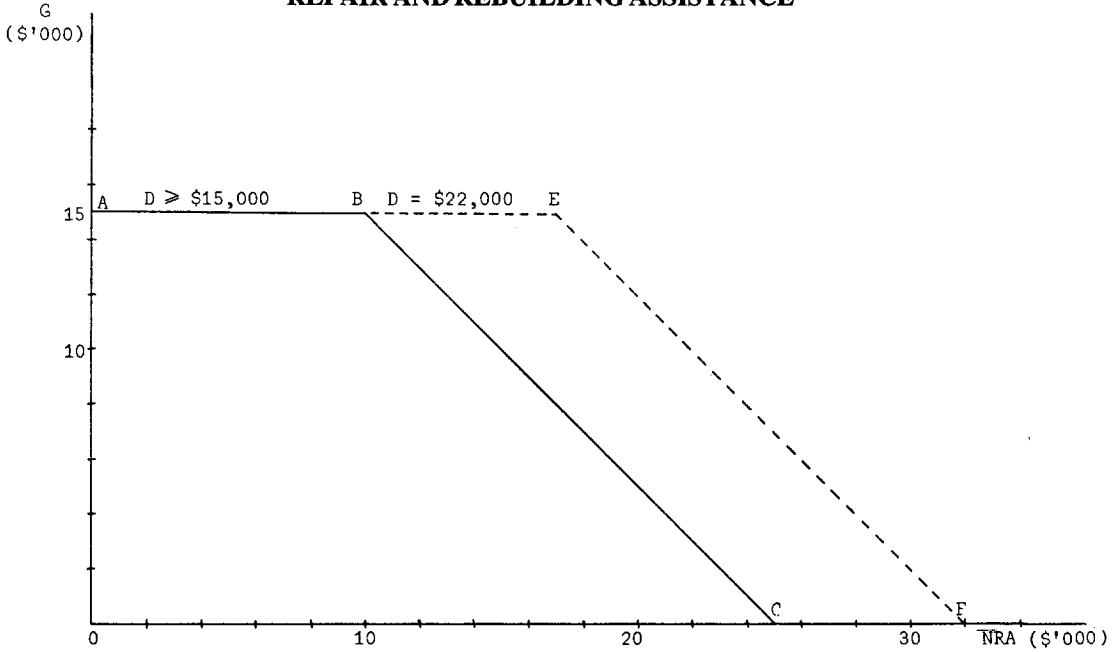
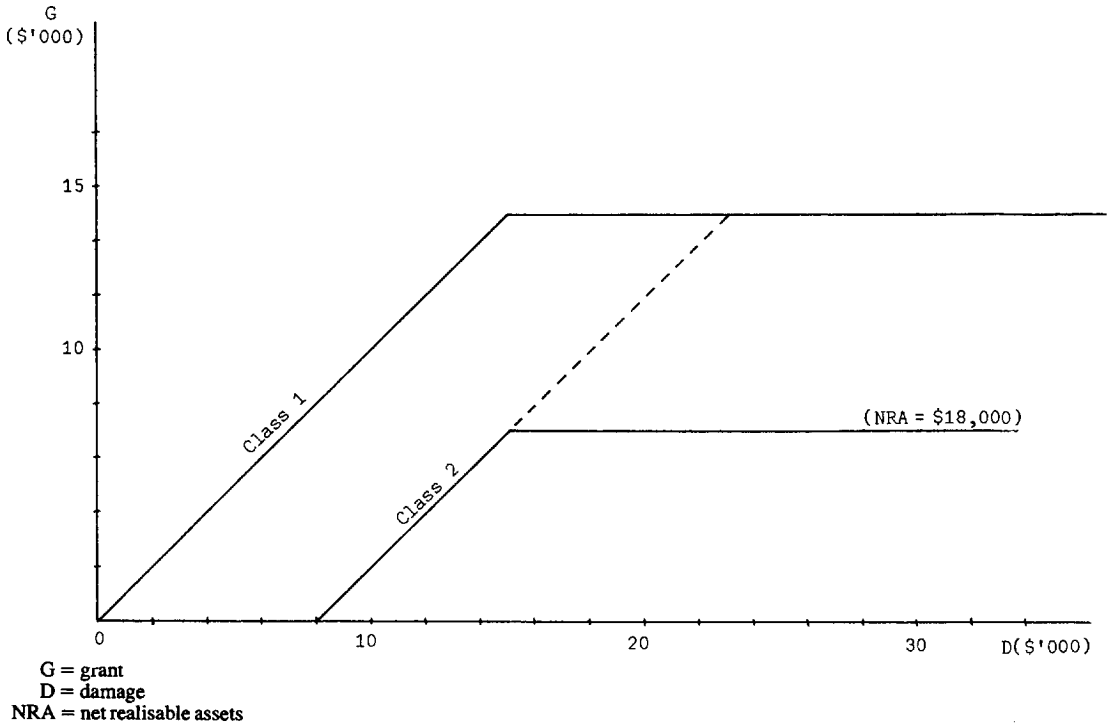


Chart V-7

VALUE OF GRANT AS A FUNCTION OF DAMAGE — HOUSING REPAIR AND REBUILDING ASSISTANCE



have thus demonstrated the second aspect of the constraint on maximum assessable damage. As compared with a constraint on the maximum grant, it will give a smaller grant to those individuals who qualify for assistance, who are subject to the wealth means test and whose damage exceeds the maximum assessable.

(2) Evaluation of the Criteria Adopted

It is clear from the analysis in the foregoing section that the relief for victims of the January 1974 flood was distributed on the basis of individuals' economic positions. We may thus presume that a distributional objective was being pursued. The theory discussed in Chapter IV thus provides the relevant benchmark for evaluating the criteria adopted in distributing the relief funds. Accordingly, our evaluation falls into two distinct parts. First, we discuss the definition of income and wealth used in applying the means tests for the distribution of each type of relief. Secondly, we consider how individuals in equal and unequal economic positions were treated relative to one another, given the definitions of income and wealth which were used.

The definitions of income and wealth which were used in distributing Personal Distress and Hardship Relief would appear to have been relatively narrow, by which we mean that they excluded a number of items one would normally include as being income or wealth. As noted earlier,²⁴ the actual definition of income was not precise. The *Authorization and Determination* referred to "average gross weekly income of the family" which would imply a rather broad definition, but the application forms for assistance simply requested "weekly income". There was no definite statement as to whether income from capital and financial assets or transfer payments were included or excluded.²⁵ The definition of wealth would seem to cover only relatively liquid assets. Wealth was referred to at one point as "bank balances, investments and other negotiable assets" and at another point as "bank balances and/or cash investments".

From an efficiency viewpoint, the excess burden arising from the use of these definitions of income and wealth may not have been significant. This is because the concepts of income and wealth to be applied were announced only when the assistance scheme was operational, so that individuals would not have had a chance to "wriggle". If, however, the concepts of income and wealth were to become a permanent part of a disaster relief scheme, the excess burden could be considerable, particularly with respect to wealth holdings. For individuals living in disaster-prone areas, there would be a distinct disincentive to hold the relatively liquid assets which fall within the definition of wealth that was employed in Queensland in 1974.

From an equity viewpoint, the definitions of income and wealth which were used could lead to vastly different treatment of individuals in equal economic positions. To the extent that income from capital and financial assets or transfer payments were excluded, the scheme would discriminate in favour of those whose income came from these sources. For example, if two individuals each had a wage income of \$120 per week, they would receive equal treatment even though one of the individuals earned an extra \$40 per week from a rented house which he owned. If a person's sole source of income was from capital and financial assets, the scheme would probably have detected this since an income figure of zero would have aroused suspicion. However, it is by no means clear that all sources of income would have been detected and included.

Similar comments apply regarding the inequities arising from the definition of wealth which was used. For example, a person who owned a late model motor vehicle but who held only a small amount of liquid assets would not have been excluded from assistance by the wealth means test. However, a person who was similar in other respects but who owned no motor vehicle and held \$5,000 in a savings bank account would have been completely excluded from assistance. Another person similar in other respects who owned a \$7,000 block of land (in addition to his owner-occupied dwelling) would also have been completely excluded, because ownership of real estate in addition to an owner-occupied dwelling automatically excluded a person from assis-

²⁴ See n.9.

²⁵ With the exception of child endowment payments, which were specifically excluded.

tance.²⁶ In a period of inflation, people have an incentive to shift into illiquid financial assets and real assets if these provide a better 'hedge' against inflation. The wealthier a person is, the more he will benefit from hedging against inflation.

It might be argued that the definition of wealth which was used could be defended on two grounds. First, it might be considered that the appropriate concern of such an assistance scheme, should be how quickly a person can obtain money for emergency relief. In this case, a measure of liquid assets rather than total assets is relevant. Secondly, it might be considered impracticable to attempt to assess a person's net worth. Liquid asset holdings are more easily identified and hence administratively more practical to use as the definition of wealth.

There is very little substance in either of these arguments. In the first case, even if one accepted the underlying equity proposition that those who cannot obtain funds quickly from their own resources should be given larger grants (a proposition which we find unacceptable), persons with larger holdings of illiquid assets may well be able to obtain funds quickly through borrowing from financial intermediaries. Liquid assets may thus not be the relevant index of equality. In any case, we find the underlying equity proposition unacceptable because it seems more appropriate that the assistance scheme be concerned with the person's overall financial ability to cope with the loss from the disaster. This would require a much broader conception of wealth than simply liquid assets.

The second possible argument in favour of the wealth definition adopted is really an argument against the use of wealth as an index of equality. Even when the definition of income used is not comprehensive, the administrative complexities of using wealth as part of the index militate against its use. These complexities were discussed in Chapter IV. The point is neatly summarised in the following quotation concerning the implementation of net worth taxation:

"The administrative complexities of the tax thus can produce substantial inequities in its operation. This can best be illustrated by reference to the Swedish experience . . . What Swedish experience illustrates is that the need to adopt simplified valuation procedures to prevent unacceptably high administrative costs can introduce significant inequities into the operation of a wealth tax, with those persons owning illiquid assets receiving favourable treatment vis-à-vis those owning more liquid assets. It would be unrealistic to expect that similar inequities would not arise in a country such as Australia where, particularly because of the large rural sector, there are many persons with significant wealth held in an illiquid form."²⁷

It must also be pointed out that liquid assets are not necessarily the most easily identified. A person may hold large sums of cash concealed in his mattress, or he may simply fail to disclose assets such as building society deposits. The problems of identification of liquid assets may be quite considerable.

The above comments relating to the efficiency and equity aspects of the definition of wealth used in the means test for distributing Personal Distress and Hardship Assistance are also applicable to the definition of net realisable assets in the Housing Repair and Rebuilding Assistance scheme. The definition of net realisable assets, although imprecise, seems to have been based mainly upon liquid assets. The criticisms of the definition of wealth in the Personal Distress and Hardship Assistance scheme are thus directly applicable to the definition of net realisable assets and its use as an index of equality for Housing Repair and Rebuilding Assistance.

We now proceed to the second part of the evaluation of the criteria adopted for distributing relief funds after the January 1974 flood. In this part of the evaluation, we take as given the definitions of income and wealth which were used and consider how individuals in equal and unequal economic positions were treated relative to one another. The theoretical basis of these comparisons was established in Chapter IV, where it was argued that, to satisfy the principles of horizontal and vertical equity, people in equal economic positions should be treated equally with respect to the value of damage borne by an individual. With regard to the question of vertical equi-

²⁶ Appendix A presents some data on the extent to which personal net worth in Australia is held in the form of the financial assets mentioned in the *Authorization and Determination*.

²⁷ Australian Treasury, *Net Wealth Taxes*, A.G.P.S., Canberra, 1974, p. 13. The Asprey Committee was opposed to the introduction of a wealth tax in Australia for similar reasons. See Taxation Review Committee, *Full Report*, A.G.P.S., Canberra, 1975, Chapter 26.

Table V-13

FORMULAE FOR DETERMINING VALUE OF DAMAGE BORNE BY THE APPLICANT — MARRIED COUPLES WITHOUT DEPENDANTS (M) — PERSONAL DISTRESS AND HARDSHIP ASSISTANCE

Case 5	$\left. \begin{array}{l} Y \leq 140 \\ W \leq 1,000 \end{array} \right\}$	$\left. \begin{array}{l} D - G = 0, \\ D - G = D - 1,200, \end{array} \right\}$	$\begin{array}{l} D \leq 1,200 \\ D > 1,200 \end{array}$
Case 6	$\left. \begin{array}{l} 140 < Y < 173.33 \\ W \leq 1,000 \end{array} \right\}$	$\left. \begin{array}{l} D - G = .03(Y - 140)D, \\ D - G = D - 1,200 + .03(Y - 140)1,200, \end{array} \right\}$	$\begin{array}{l} D \leq 1,200 \\ D > 1,200 \end{array}$
Case 7	$\left. \begin{array}{l} Y < 140 \\ 1,000 < W < 2,200 \end{array} \right\}$	$\left. \begin{array}{l} D - G = D, \\ D - G = (W - 1,000), \\ D - G = D - 1,200 + (W - 1,000), \end{array} \right\}$	$\begin{array}{l} D \leq (W - 1,000) \\ (W - 1,000) < D \leq 1,200 \\ D > 1,200 \end{array}$
Case 8	$\left. \begin{array}{l} 140 < Y < 173.33 \\ 1,000 < W < 2,200 \end{array} \right\}$	$\left. \begin{array}{l} D - G = D, \\ D - G = .03(Y - 140)D + (W - 1,000), \\ D - G = D - 1,200 + .03(Y - 140)1,200 + (W - 1,000), \end{array} \right\}$	$\begin{array}{l} D \leq \frac{(W - 1,000)}{(5.2 - .03Y)} \\ \frac{(W - 1,000)}{(5.2 - .03Y)} < D \leq 1,200 \\ D > 1,200 \end{array}$

D - G = value of damage (D) borne by applicant

Y = gross weekly income of the couple

W = wealth (as defined for this purpose)

Source: Derived by authors.

ty, if one accepts the assumptions of our analysis, then higher-income individuals should bear a larger value of damage themselves in absolute terms than lower-income individuals.

We will analyse each of the assistance schemes in turn, beginning with the Personal Distress and Hardship scheme. The formulae for determining the value of damage borne by an applicant, that is (D - G), can be obtained directly from Tables V-4 to V-11. In each case, the formulae for (D - G) can be calculated by substituting the equation for G into the expression (D - G). For purposes of illustration, we will confine our attention to married couples without dependants. The formulae for (D - G) for this type of applicant are presented in Table V-13.²⁸

The value of damage borne by the applicant as a function of damage for case 5 (no means tests applicable) and case 6 (income means test only applicable) is depicted graphically in Chart V-8. The case 5 couple receives a grant equal to damage for damage less than or equal to \$1,200. The value of damage borne by them (D - G) is then zero for damage not exceeding \$1,200 as indicated by the segment OE of the horizontal axis in Chart V-8. For damage in excess of \$1,200, the couple will bear the excess over \$1,200 themselves on a dollar-for-dollar basis. This is indicated by the line EF in Chart V-8, this line being inclined at an angle of 45° to the horizontal axis.²⁹

The case 6 couple is subject only to the income means test. For damage not exceeding \$1,200, a couple on some given income level will bear a constant fraction of the damage. For example, a couple with an income of \$150 per week will bear 30 per cent of the damage up to and including \$1,200. The maximum grant is then \$840. This is indicated in Chart V-8 by the line OH. Once the damage level exceeds \$1,200, the couple will be in receipt of their maximum grant and will bear the excess damage themselves as indicated by the line HJ in Chart V-8.³⁰ Another example of a case 6 applicant is given in Chart V-8, by the graph OKL which applies to an income level of \$160 per week.³¹ Clearly, as income increases, the relevant graph will rotate upwards about the origin, ultimately reaching OV, the 45° line through the origin, when income reaches \$173.33 per week and the grant falls to zero.

There are a number of interesting features of the Personal Distress and Hardship Assistance scheme exhibited in Chart V-8. First, couples with the same income may bear widely different values of damage themselves. This can be seen by moving along the graph for any particular income level (for example, OKL). Secondly, couples with different income levels may bear the same value of damage themselves. This can be seen by drawing a horizontal line at some particular value of (D - G). Thirdly, a couple with a higher income than other flood victims may bear a lower value of damage themselves.

To demonstrate the second and third points made above, consider the following example. Suppose there are three couples — M, N and T — in the following positions:³²

Couple	Y	D	G	D - G
M	\$100	\$1,650	\$1,200	\$450
N	\$150	\$1,290	\$ 840	\$450
T	\$160	\$ 600	\$ 240	\$360

²⁸ The formulae for the remaining categories of applicant are presented in Appendix B.

²⁹ The shape of the graph for case 5 applicants can be established mathematically from the formulae in Table V-13 as follows:

$$\frac{d(D - G)}{dD} = 0, \quad D \leq 1,200$$

$$\frac{d(D - G)}{dD} = 1, \quad D > 1,200$$

³⁰ Note that the line HJ has a slope of unity. It is thus parallel to the 45° line through the origin, OV. Now along OV, D - G = D, hence G = 0. The vertical distance between HJ and OV is then equal to the maximum grant obtained by this particular couple. An analogous argument applies to the line EF. Also, the vertical distance between lines OH and OV gives the value of the grant received by the relevant couple for any particular damage level. Similarly, the vertical distance between the lines OE and OV indicates the value of the grant received by case 5 applicants over the relevant range of damage.

³¹ Mathematically, for case 6 applicants

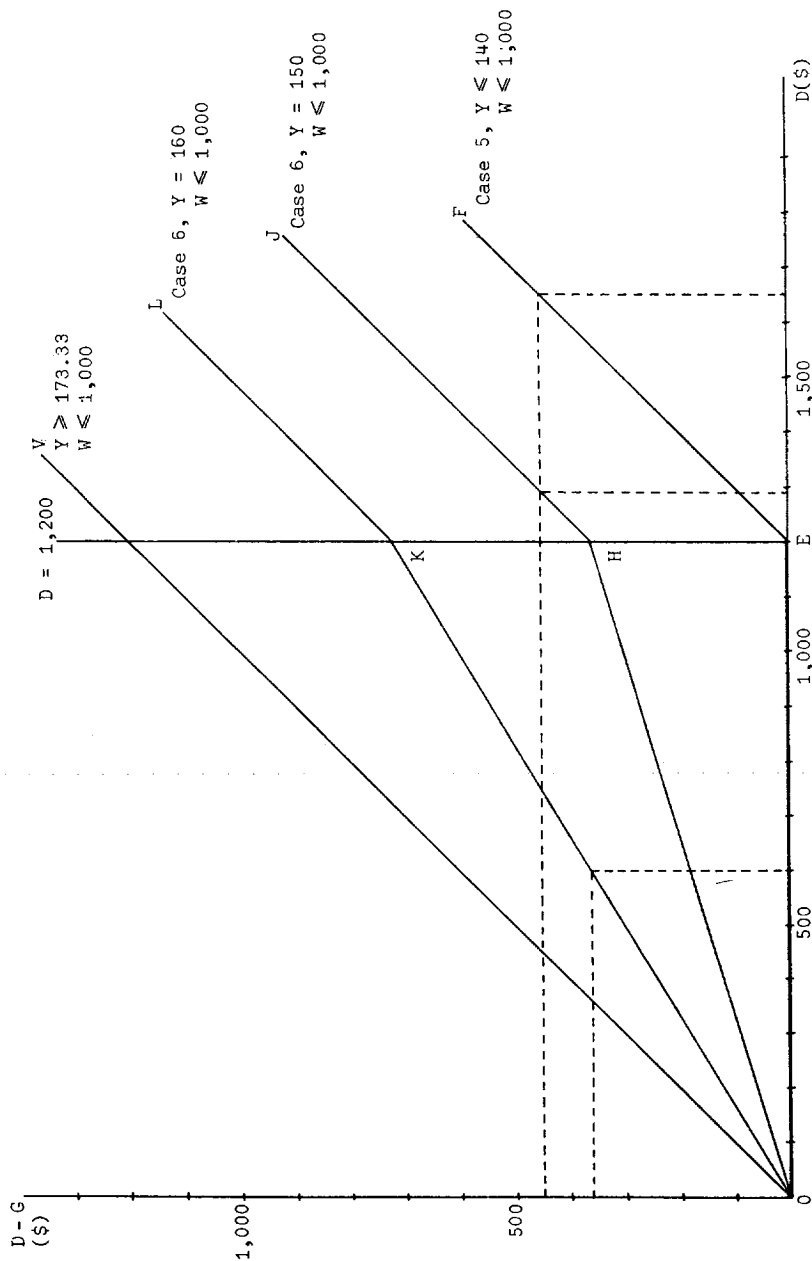
$$\frac{d(D - G)}{dD} = .03(Y - 140), \quad D \leq 1,200$$

$$\frac{d(D - G)}{dD} = 1, \quad D > 1,200$$

³² This particular example is illustrated in Chart V-8 by dashed lines.

Chart V-8

VALUE OF DAMAGE BORNE BY APPLICANT AS A FUNCTION OF DAMAGE — CASES 5 AND 6,
PERSONAL DISTRESS AND HARSHIP ASSISTANCE



D - G = value of damage (D) borne by applicant

Y = gross weekly income of married couple

W = wealth (as defined)

The second point above is clearly demonstrated. Both M and N bear \$450 worth of damage but their income levels are quite different. The third point is demonstrated with reference to couple T. This couple has a higher income than either M or N but bear only \$360 damage themselves as compared to the \$450 borne by each of M and N.

In drawing the above conclusions, there is a potential pitfall which one must be careful to avoid. This relates to the fact that, because the value of a grant must be non-negative, an applicant can never bear more than the total value of the damage incurred. Thus, solely because of differences in the total value of damage as between applicants, situations will inevitably arise where applicants with different income levels will bear the same value of damage themselves, and where applicants with the same income level will bear different values of damage themselves. For example, consider a couple with income of \$180 per week and total damage of \$450. They will bear this amount fully themselves as indicated by the line OV in Chart V-8. Clearly, there will be lower-income individuals who will bear the same value of damage. However, in this case we would not consider that the equity principles have been violated because, unless the higher-income applicant is made to pay an amount *into* the assistance scheme, there is no way in which the assistance scheme itself can take this matter into consideration.

The potential pitfall is starkly illustrated in comparisons of couples whose incomes are such as to preclude any grant (i.e. $Y \geq \$173.33$) with couples whose incomes will entitle them to some assistance. However, a potential pitfall still exists in comparisons between couples each of whom is entitled to a grant. Consider again couples N and T in the previous example, but this time suppose T has incurred total damage of \$400. This is illustrated in Chart V-9. The value of damage borne by N is read off the graph OHJ — this couple will bear \$450 of a total damage of \$1,290. The value of damage borne by T is read off the graph OKL — this couple will bear \$240 of the total damage of \$400. The situation, then, is as follows:

Couple	Y	D	G	D - G
N	\$150	\$1,290	\$840	\$450
T	\$160	\$ 400	\$160	\$240

Now even if couple T were to bear the full value of damage themselves, (\$400), they would still bear a smaller amount than N who has borne \$450. This difference could not be considered to be inequitable, because it arises because of the difference between the total value of damage borne by T and N respectively.³³ However, what the assistance scheme does in this case is exacerbate the difference by giving couple T a grant of \$160 and reducing the value of damage borne by them to \$240. Thus, the "scaling in" effect whereby a couple loses 3 per cent of their grant for each dollar of excess income can be considered to be a source of inequity in the scheme.

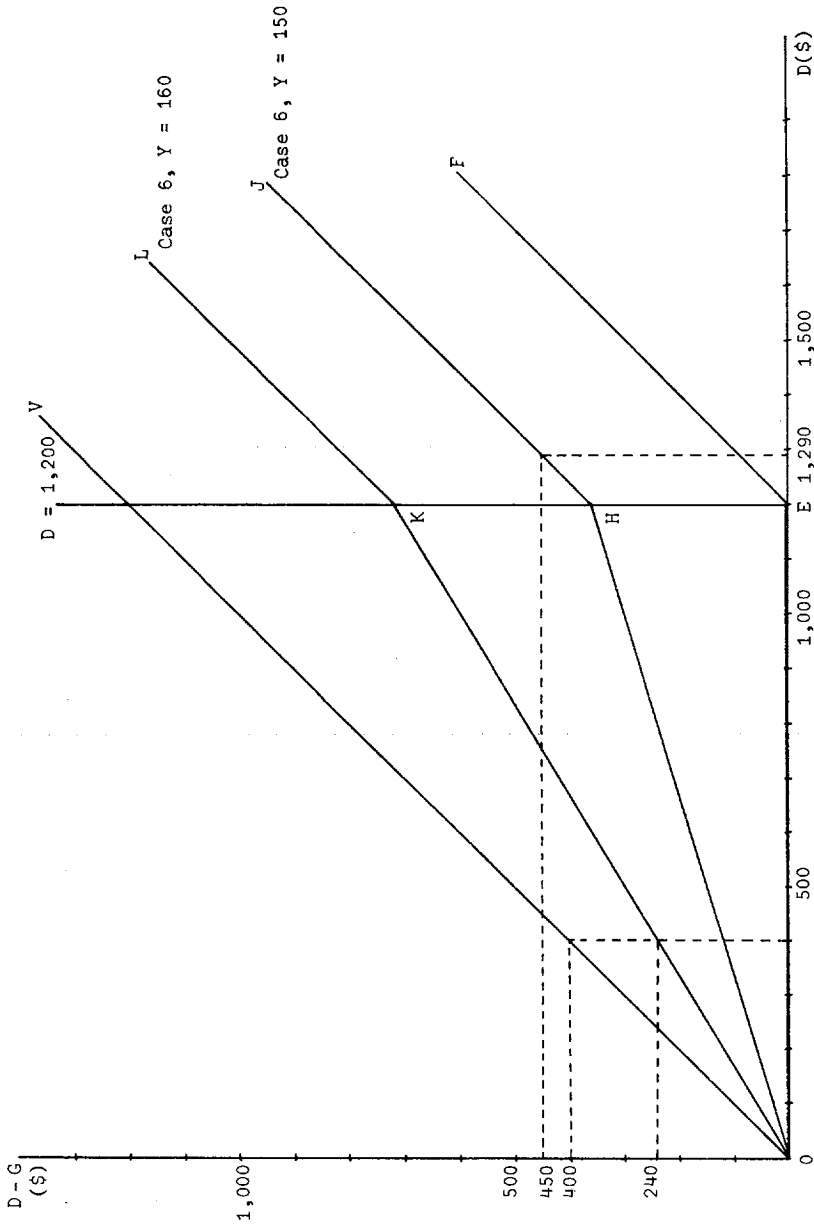
The original example, as illustrated in Chart V-8, does not involve the pitfall just discussed. The inequities which arise are in no part due to one of the couples bearing the full amount of damage themselves and, because of this, being unable to achieve an equitable position with respect to the other couples. In the case of T, the inequity can be attributed entirely to the "scaling in" effect of the income means test. It would be quite possible for T, under an alternative scheme, to bear a higher value of damage than either M or N.

The example in Chart V-8 may also be used to illustrate another source of inequity in this scheme. Consider the couples M and N. They both bear the same value of damage themselves even though they have substantially different incomes. The reason for this lies in the open-ended nature of the scheme from the applicant's point of view. As damage increases, the couple's contribution increases without limit. Note that this would be the case whether a couple paid for all damage in excess of the maximum allowable (as they do in this scheme) or whether they paid for only a fraction of the excess damage. As long as the value of damage borne by the applicant is positively related to damage, the scheme will have this open-ended characteristic.

³³ It may be argued that vertical equity could be achieved by reducing the value of damage borne by N to below that of T by increasing the grant to N. If this argument were taken to its logical conclusion, however, the result would be that no one with an income below \$173.33 would pay anything since it would always be possible to find a higher-income person who would bear a smaller value of damage himself due to a smaller total value of damage.

Chart V-9

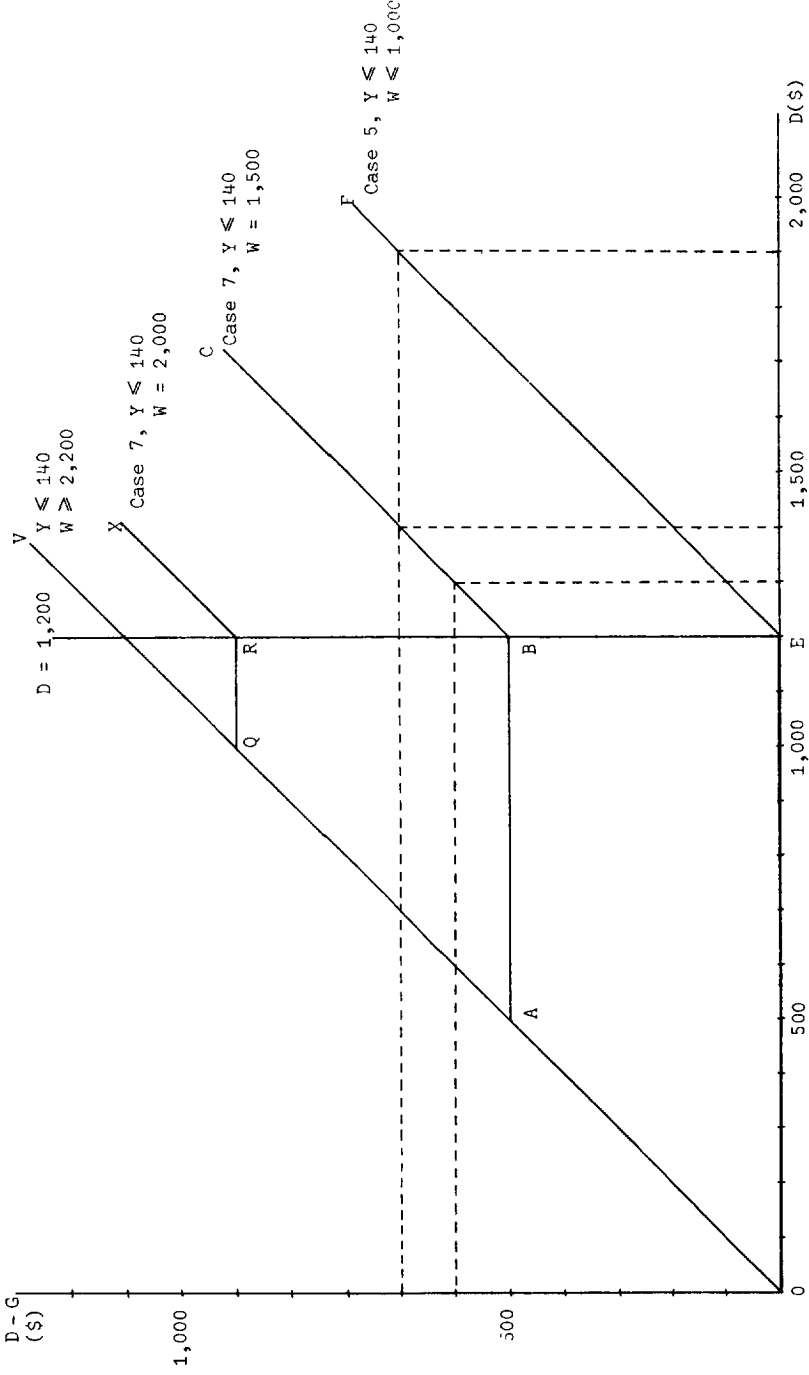
VALUE OF DAMAGE BORNE BY APPLICANT AS A FUNCTION OF DAMAGE — CASES 5 AND 6,
PERSONAL DISTRESS AND HARSHSHIP ASSISTANCE



D - G = value of damage (D) borne by applicant

Y = gross weekly income of married couple

Chart V-10
VALUE OF DAMAGE BORNE BY APPLICANT AS A FUNCTION OF DAMAGE — CASES 5 AND 7,
PERSONAL DISTRESS AND HARDSHIP ASSISTANCE



D-G = value of damage (D) borne by applicant
Y = gross weekly income of married couple
W = wealth (as defined)

The value of damage borne by the applicant as a function of damage for case 5 (no means test applicable) and case 7 (wealth means test only applicable) is depicted in Chart V-10. The graph for the case 5 couple — OEF — is identical to that in Charts V-8 and V-9. The case 7 applicants are subject to the wealth means test. The damage threshold is equal to the amount of excess wealth. For example, suppose the couple has wealth of \$1,500. Their excess wealth is then \$500. For damage up to and including \$500, the entire amount is borne by the couple. The segment OA of the line OV (the 45° line) is then applicable to this couple. For damage between \$500 and \$1,200, the couple bears a constant \$500 as shown by the line AB. Once damage reaches \$1,200, the maximum grant obtainable by the couple — an amount of \$700 — is achieved. For damage in excess of \$1,200, the couple bears the full amount of the excess damage as shown by the line BC.³⁴ The graph for the case 7 applicant with wealth of \$1,500 is thus OABC. Another example of a case 7 applicant is given in Chart V-10 by the graph OQRX, which applies to a couple with wealth of \$2,000.³⁵ In the limiting case when wealth reaches \$2,200, the graph becomes OV — the 45° line — with no assistance payable.

The same three features noted about the effects of the income means test are evident in Chart V-10. First, couples with the same wealth may bear widely different values of damage themselves. Secondly, couples with different levels of wealth may bear the same value of damage themselves. Thirdly, a couple with more wealth than other flood victims may bear a smaller value of damage. These features can be seen in the following numerical example. Suppose we have three couples — H, J and K — in the following positions:³⁶

Couple	W	D	G	D - G
H	\$ 800	\$1,900	\$1,200	\$700
J	\$1,500	\$1,400	\$ 700	\$700
K	\$1,500	\$1,300	\$ 700	\$600

The first point is demonstrated with reference to couples J and K, who have the same wealth but bear different values of damage themselves. The second point is demonstrated with reference to couples H and J, who have different levels of wealth but bear the same value of damage themselves. The third point is demonstrated with reference to couples H and K, the latter having more wealth but bearing a smaller value of damage.

The potential pitfall noted in comparisons between couples subject to the income means test is again present. For example, if the couple K with wealth of \$1,500 had damage of \$400, there would be no way, apart from making them contribute to the assistance fund, of getting them to bear the same value of damage as couple J.³⁷ This pitfall is not present in the above example.

The same inequities as were shown to result from the operation of the income means test thus also result from the operation of the wealth means test. However, under the income means test it was seen that the inequities could arise from two sources. First, the "scaling in" effect could in some cases lead to perverse treatment of couples in terms of the equity principles. Secondly, the open-ended financial commitment faced by flood victims was shown to be a source of inequity. Under the wealth means test, the "scaling in" effect does not occur and only the second of the two sources of inequity is present. The couple bear all damage up to the damage threshold, then bear a constant value of damage up to the maximum assessable damage of \$1,200. Indeed, if one makes comparisons only between couples with damage *less than* \$1,200, the equity criteria

³⁴ The line BC thus has a slope of unity. The vertical distance between BC and OV equals the maximum grant obtainable (\$700 in this example).

³⁵ Mathematically, for case 7 applicants

$$\frac{d(D - G)}{dD} = 1, \quad D \leq (W - 1,000)$$

$$\frac{d(D - G)}{dD} = 0, \quad (W - 1,000) < D \leq 1,200$$

$$\frac{d(D - G)}{dD} = 1, \quad D > 1,200.$$

³⁶ The positions are illustrated in Chart V-10 by the dashed lines.

³⁷ The point made in n. 33 is also applicable here.

are fulfilled. As wealth increases, couples will move on to higher horizontal lines in Chart V-10, so that couples with higher wealth will bear a higher value of damage themselves. Also, as the horizontal line indicates, couples with the same wealth bear the same value of damage themselves. Inequities will seem to arise only if "pitfall comparisons" are made. The only way inequities may seem to exist is where a couple with higher wealth have a total value of damage which is less than the value of damage borne by a couple with lower wealth. In this case, the couple with the higher wealth will be on the 45° line OV and could only bear more if made to pay into the scheme. This is in direct contrast to the situation in Charts V-8 and V-9 for couples with damage less than \$1,200.

Inequities arise under the wealth means test once couples with damage in excess of \$1,200 are admitted into the comparisons, for it is then that the open-endedness of the scheme comes into effect. The consequences are exactly analogous to those resulting from this characteristic of the income means test.

The value of damage borne by the applicant as a function of damage for case 5 (no means test applicable) and case 8 (both means tests applicable) is depicted in Chart V-11. The graph for the case 5 couple — OEF — is identical to that in Charts V-8, V-9 and V-10. The case 8 applicants are subject to both the income and wealth means tests. The damage threshold is given by the following formula:³⁸

$$D_t = \frac{(W - 1,000)}{(5.2 - .03Y)} \quad (D_t = \text{damage threshold}).$$

For example, suppose the couple has income of \$150 per week and wealth of \$1,200. The damage threshold is then approximately \$286. Damage up to and including this amount is borne entirely by the couple. The segment OC of the line OV (the 45° line) in Chart V-11 is then relevant over this range of damage. For damage between \$286 and \$1,200, a grant becomes payable and the income means test becomes operative. With excess income of \$10 per week, the grant will be abated at the rate of \$0.30 for each one dollar so that, for damage in excess of \$286, the couple will bear \$0.30 for each dollar of the excess damage up to total damage of \$1,200. This is illustrated by the line CH in Chart V-11. Once damage of \$1,200 is reached, the maximum grant is obtained. Thereafter, the couple will bear the full amount of the extra damage as indicated by the line HJ. Another example of a case 8 applicant is given by the graph OMNP.³⁹ The line OV applies to those couples who have either income levels equal to or greater than \$173.33 per week or levels of excess wealth equal to or greater than the amount of damage (subject to maximum assessable damage of \$1,200) or some combination of income and wealth levels which reduce the grant to zero.⁴⁰

The same features noted in Charts V-8 to V-10 are again evident in Chart V-11, as indicated by the dashed lines. As with previous cases, one must be careful to avoid making "pitfall comparisons". Notice that, because the income means test is applicable, the "scaling in" effect is

³⁸ The derivation is analogous to that in n. 12.

³⁹ Mathematically, for case 8 applicants

$$\begin{aligned} \frac{d(D - G)}{dD} &= 1, & D &\leq \frac{(W - 1,000)}{(5.2 - .03Y)} \\ \frac{d(D - G)}{dD} &= .03(Y - 140), & \frac{(W - 1,000)}{(5.2 - .03Y)} &< D \leq 1,200 \\ \frac{d(D - G)}{dD} &= 1, & D &> 1,200 \end{aligned}$$

⁴⁰ For example, if a couple suffers damage of \$600, they will receive no grant if their income is equal to or greater than \$173.33 or if their wealth is equal to or greater than \$1,600. Within these upper limits, there are a range of combinations of income and wealth levels which will also reduce the grant to zero. In this example, such combinations are given by the formula

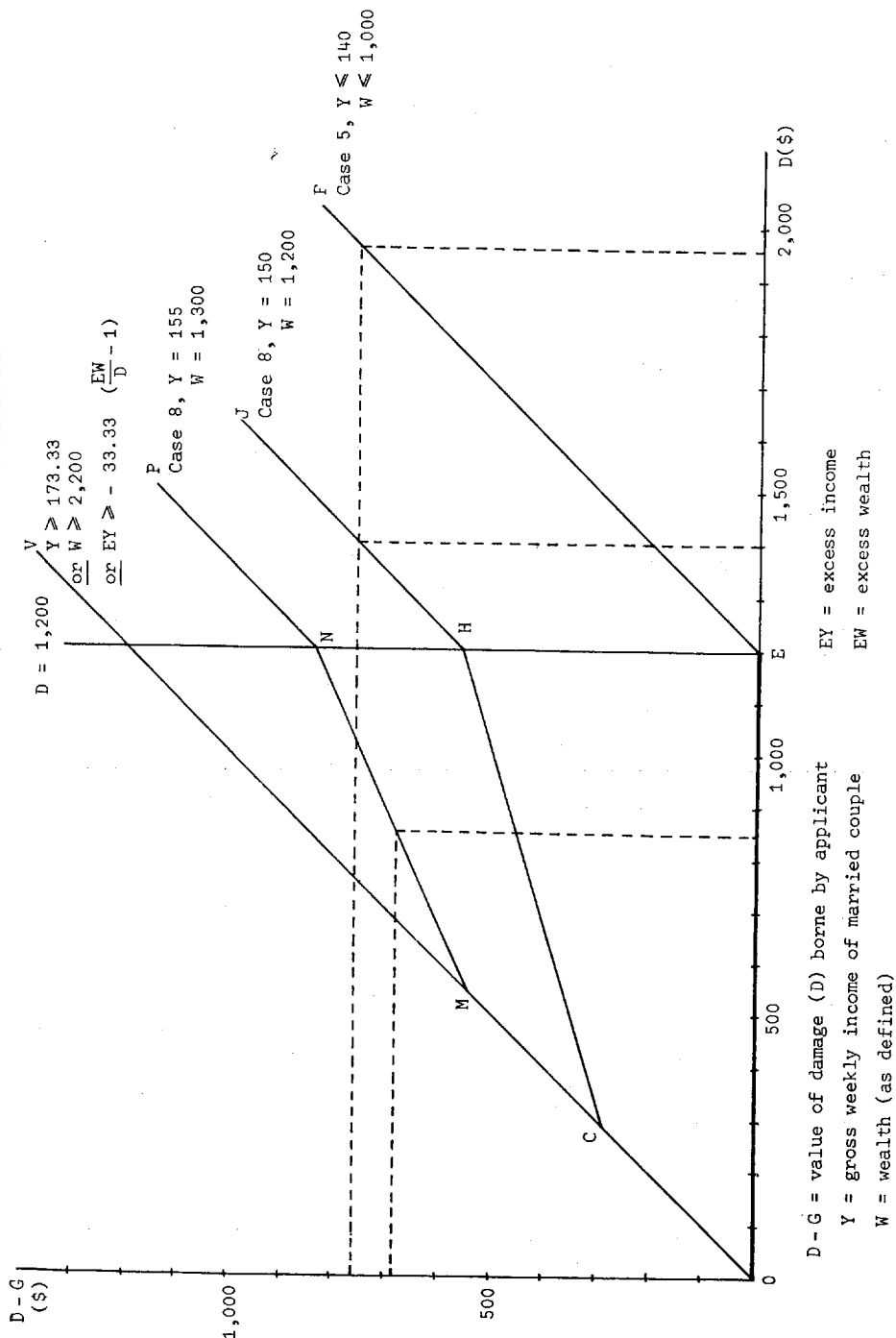
$$\begin{aligned} \text{where} \quad EY &= .05555 \text{ EW} + 33.33 \\ EY &= \text{excess income} \\ EW &= \text{excess wealth.} \end{aligned}$$

One such combination which will reduce the grant to zero is then income of \$151.11 per week and wealth of \$1,400. In general, such combinations for any given damage level (D) are given by the formula

$$EY = -33.33 \left(\frac{EW}{D} - 1 \right)$$

Chart V-11

VALUE OF DAMAGE BORNE BY APPLICANT AS A FUNCTION OF DAMAGE — CASES 5 AND 8,
PERSONAL DISTRESS AND HARSHIP ASSISTANCE



present and is again a source of inequity. The open-ended nature of the applicant's commitment is also evident, giving rise to a second source of inequity.

A set of graphs similar to Charts V-8 to V-11 could be drawn for each of the remaining seven types of applicant. The graphs would retain the same general shape but the maximum assessable damage and the income limit for the income means test could differ. The same three features noted about Charts V-8 to V-11 would again be evident.⁴¹

Our comparisons of the treatment of people in equal and unequal economic positions have so far been restricted to people with the same status. In terms of Table V-3, the comparisons have been between applicants on the same row in the matrix and not between applicants on different rows. In particular we have, for illustrative purposes, concentrated on the treatment of married couples without dependants relative to one another. It is also possible to compare the relative treatment of applicants with different status. In terms of Table V-3, this involves comparisons of cases on different rows in the matrix. Clearly, there is a vast number of such comparisons one could make. However, since all such comparisons would indicate the same problem in the Personal Distress and Hardship scheme, we will simply explore one comparison, namely that between single persons without dependants and married couples without dependants, each of whose entitlement is affected only by the income means test. Thus, we will consider the relative treatment of cases 2 and 6.

The distinction between the two types of applicant is based upon marital status. Taxation systems often consider this distinction to be a relevant factor in defining the index of equality. A case in equity can be made for giving more favourable taxation treatment to a married couple which has the same income as a single person.⁴² This conception is also present in the Personal Distress and Hardship scheme, with income and maximum assessable damage limits for married couples being higher than those applying to single persons.

In order to compare the treatment of married couples and single persons, we need to know under what circumstances they are considered to be "equals" in terms of the principle of horizontal equity. To establish a basis for comparison, we will assume that, when each type of applicant has equal excess income, they are in equal economic positions.

Chart V-12 depicts the graphs for the value of damage borne by an applicant as a function of damage for a case 2 individual and a case 6 couple. We will assume that the single person has an income of \$110 per week (graph OHJ) and that the married couple has an income of \$150 per week (graph OMN). Both applicants then have excess income of \$10 per week and hence, by our assumption, they can be regarded as being in equal economic positions. It is clear from Chart V-12 that the scheme is inequitable in that the two applicants may bear widely differing values of damage themselves.⁴³ It is also clear that this arises from the open-ended nature of the commitment required of the applicant. This same point would emerge from comparisons of the relative treatment of other types of applicant. Thus, inequities arise in the relative treatment of applicants with different status as well as in the relative treatment of applicants with the same status.

We now turn to an evaluation of the Housing Repair and Rebuilding scheme, taking as given the definition of net realisable assets which was employed. Again, we are interested in how individuals in equal and unequal economic positions were treated relative to one another in terms of the value of damage which they had to bear themselves. If the equity criteria were satisfied, we would expect people with equal net realisable assets to bear equal values of damage and the value of damage borne by applicants to increase as their net realisable assets increased.

The formulae for the value of damage borne by an applicant under this scheme can be obtained from Table V-12 by inserting the equations for G into the expression $(D - G)$. The resulting formulae are presented in Table V-14. The associated graphs are presented in Chart V-13.

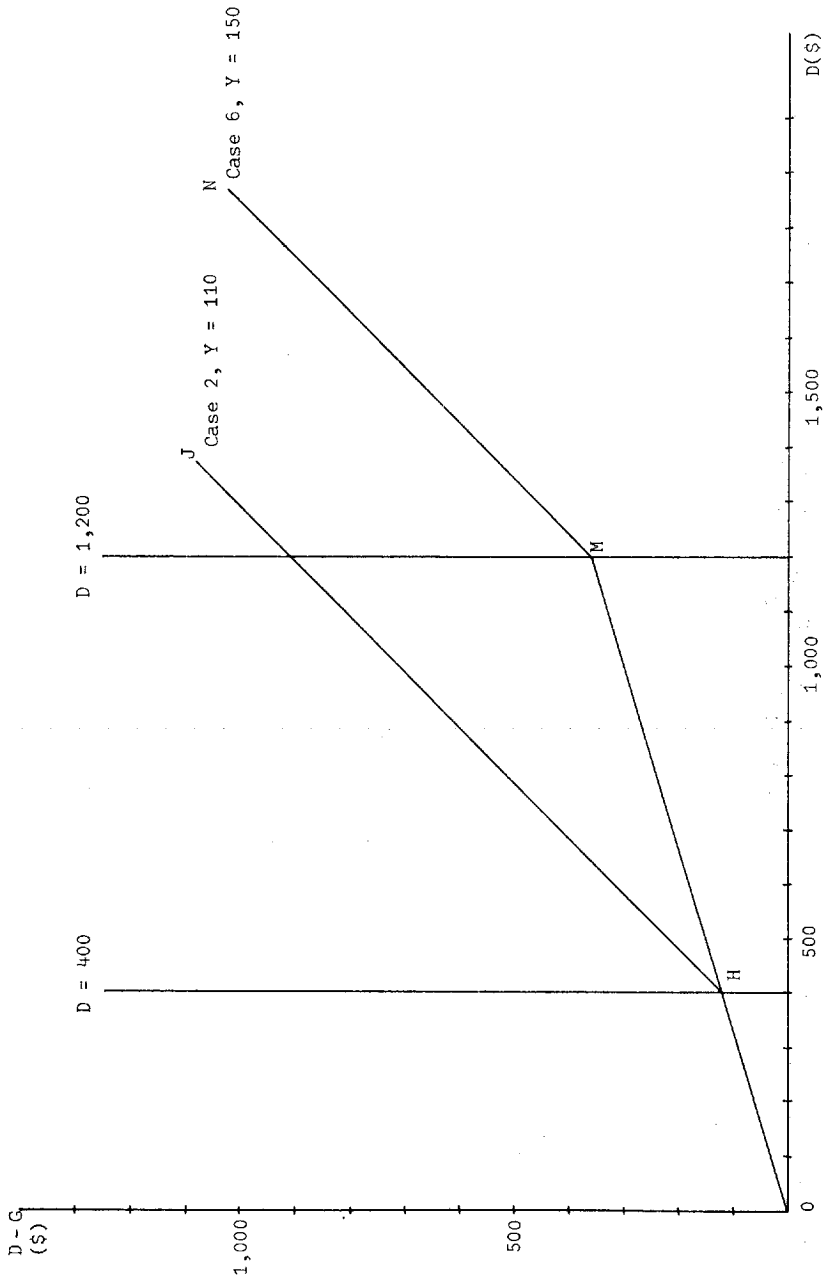
⁴¹ As an example, the graphs for cases 9-12 are presented in Appendix C.

⁴² See R. A. Musgrave and P. B. Musgrave, *Public Finance in Theory and Practice*, 1st edn, McGraw-Hill, New York, 1973, pp. 257-9.

⁴³ Note again that "pitfall comparisons" must be avoided.

Chart V-12

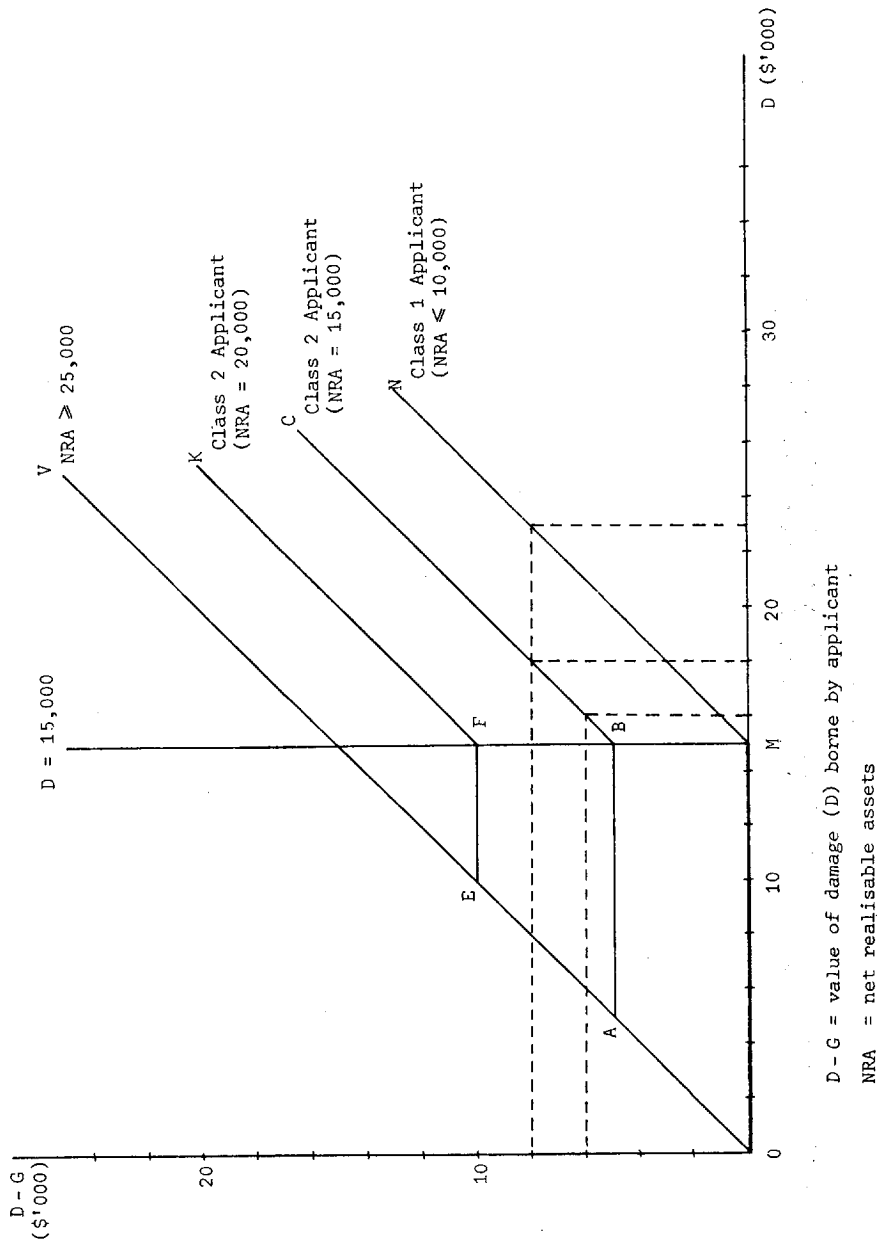
VALUE OF DAMAGE BORNE BY APPLICANT AS A FUNCTION OF DAMAGE — CASES 2 AND 6,
PERSONAL DISTRESS AND HANDSHIP ASSISTANCE



D - G = value of damage (D) borne by applicant

Y = gross weekly income of individual (Case 2) or married couple (Case 6)

Chart V-13
VALUE OF DAMAGE BORNE BY APPLICANT AS A FUNCTION OF DAMAGE — HOUSING REPAIR AND REBUILDING ASSISTANCE



The Class 1 applicant bears no damage himself for damage up to and including \$15,000. Thereafter, he bears the whole of the extra damage himself. This is demonstrated by the graph OMN in Chart V-13. The segment MN will cut the horizontal axis at an angle of 45°. ⁴⁴

Table V-14

FORMULAE FOR DETERMINING THE VALUE OF DAMAGE BORNE BY THE APPLICANT — HOUSING REPAIR AND REBUILDING ASSISTANCE

Class 1 Applicant	(NRA ≤ \$10,000)	
	D - G = 0,	D ≤ 15,000
	D - G = D - 15,000,	D > 15,000
Class 2 Applicant	(\$10,000 < NRA ≤ \$25,000)	
	D - G = D,	D ≤ (NRA - 10,000)
	D - G = (NRA - 10,000),	(NRA - 10,000) < D ≤ 15,000
	D - G = D - 15,000 + (NRA - 10,000),	D > 15,000

D - G = value of damage (D) borne by applicant

NRA = net realisable assets

Source: Derived by authors.

The Class 2 applicant receives no grant until damage reaches the damage threshold. For example, consider an applicant with net realisable assets of \$15,000. Excess net realisable assets amount to \$5,000. For damage up to and including \$5,000, the applicant bears all the damage himself. This is shown by the segment OA of the line OV (the 45° line) in Chart V-13. For damage exceeding \$5,000 and up to \$15,000, the applicant bears a constant \$5,000 as illustrated by the line AB in Chart V-13. For damage in excess of \$15,000, the applicant bears the full excess damage himself as shown by the line BC. Another example of a Class 2 applicant is given by the graph OEFK. ⁴⁵

The same three features noted about the Personal Distress and Hardship scheme are also evident in this scheme. This is to be expected, for the means test used in this scheme is, in principle, the same as the wealth means test used in the Personal Distress and Hardship scheme. Consider three applicants — X, Y and Z — in the following positions:

Individuals	NRA	D	G	D - G
X	\$ 5,000	\$23,000	\$15,000	\$8,000
Y	\$15,000	\$18,000	\$10,000	\$8,000
Z	\$15,000	\$16,000	\$10,000	\$6,000

It can be seen, first, that applicants with the same net realisable assets may bear different values of damage themselves. This is demonstrated with reference to applicants Y and Z. Secondly, applicants with different net realisable assets may bear the same value of damage themselves. This can be seen by comparing applicants X and Y. Thirdly, an applicant with more net realisable assets than other applicants may bear a smaller value of damage. This can be seen by comparing individuals X and Z. ⁴⁶

⁴⁴ Mathematically, for Class 1 applicants

$$\frac{d(D - G)}{dD} = 0, \quad D \leq 15,000$$

$$\frac{d(D - G)}{dD} = 1, \quad D > 15,000$$

⁴⁵ Mathematically, for Class 2 applicants

$$\frac{d(D - G)}{dD} = 1, \quad D \leq (NRA - 10,000)$$

$$\frac{d(D - G)}{dD} = 0, \quad (NRA - 10,000) < D \leq 15,000$$

$$\frac{d(D - G)}{dD} = 1, \quad D > 15,000$$

⁴⁶ The comparisons are illustrated in Chart V-13 with reference to the dashed lines.

The potential pitfall noted in the comparisons made in our analysis of the Personal Distress and Hardship scheme also exists in the present analysis. The reasoning is exactly the same as in the analysis of those cases subject to the wealth means test in the Personal Distress and Hardship scheme and will not be repeated here. The equity principles are violated in the Housing Repair and Rebuilding scheme as illustrated in Chart V-13 because of the open-ended commitment of the applicant as damage increases. In comparisons between individuals with damage less than \$15,000, the equity principles are fulfilled. The reasoning underlying these conclusions is exactly analogous to that underlying the conclusions regarding the wealth means test in the Personal Distress and Hardship scheme.

A further source of inequity in the Housing Repair and Rebuilding scheme is the failure to take into account other factors usually deemed relevant to the index of equality. In particular, the marital status and number of dependants of an applicant were completely ignored. The scheme drew no distinction between, for example, a single person without dependants and a married couple with four dependent children. The same net realisable assets and maximum assessable damage limits were applied to all applicants.

The conclusions of our evaluation of the criteria adopted may now be summarised. The definitions of income and wealth used in the Personal Distress and Hardship scheme and the definition of net realisable assets used in the Housing Repair and Rebuilding scheme were not precise and were less than comprehensive. While this might have presented no problem from an efficiency viewpoint because of the *ad hoc* nature of assistance given in the past, it would have given rise to widely disparate treatment of individuals who were in equal economic positions on the basis of comprehensive definitions of income or wealth.

Even if one were to accept the definitions of income and wealth which were used, the schemes were still inequitable because they violated the principles of horizontal and vertical equity. In comparisons of the treatment of individuals on the basis of the value of damage borne by the applicant, the following inequities were found in both schemes. First, applicants with the same income and/or wealth may have borne widely different values of damage themselves. Secondly, applicants with different levels of income and/or wealth may have borne the same value of damage themselves. Thirdly, applicants with higher income and/or wealth than other flood victims may have borne a lower value of damage themselves. A source of the inequities in both schemes was the open-ended nature of the schemes from the applicant's viewpoint; there was no limit on the value of damage to be borne by the applicant. A further source of inequity in the Personal Distress and Hardship scheme was the "scaling in" effect of the income means test. The fact that applicants were given assistance proportionate to the total value of damage up to the maximum assessable damage enabled some higher-income applicants, in situations where their *total* damage exceeded that borne by lower-income applicants, to reduce the value of damage borne by themselves to a level below that borne by lower-income applicants over this range of damage. In situations where the *total* value of damage suffered by higher-income applicants was less than the value of damage borne by lower-income applicants, the grant given to the higher income applicants exacerbated this difference.

Another inequitable feature of the Housing Repair and Rebuilding scheme was the failure to recognise non-financial differences between applicants which are usually considered relevant to the index of equality. In particular, no distinction was drawn between single and married couples with and without dependants.

A natural counterpart to an evaluation of government policy is a discussion of proposals for reform. In view of the inequities which existed in the assistance schemes which were implemented following the January 1974 flood, what are the possible alternative schemes? To this question we turn in the final chapter.

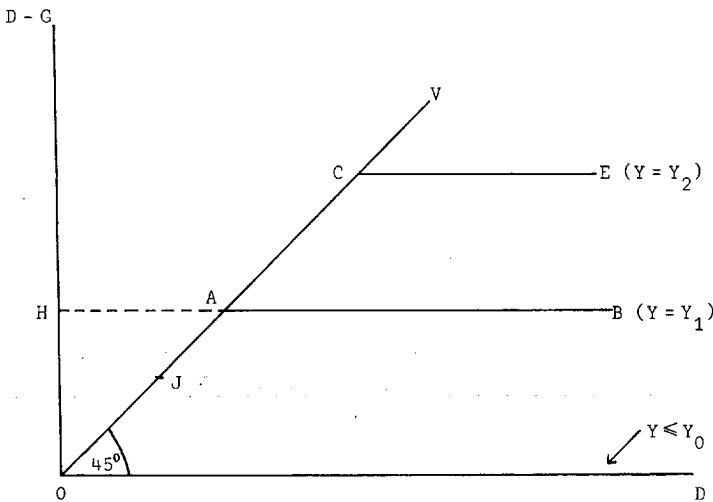
VI AN ALTERNATIVE SCHEME

(1) Equitable Deductibles — Relating Damage Borne to Income

If we assume that the government wishes to pursue a distributional objective in providing natural disaster relief to individuals, the basis of an alternative scheme is provided by the theoretical analysis of Chapter IV. In particular, the relief should be distributed on the basis of what we called an "equitable deductible" — a deductible which is related to an individual's income. In an "ideal" scheme, a comprehensive definition of income would be used and the amount of the deductible would be positively related to an individual's income. Such a scheme is illustrated graphically in Figure VI-1. This figure depicts the value of damage borne by the applicant (or the deductible) as a function of damage in the alternative scheme.

Figure VI-1

**VALUE OF DAMAGE BORNE BY APPLICANT AS A FUNCTION OF DAMAGE
— AN ALTERNATIVE SCHEME**



D - G = value of damage (D) borne by applicant
Y = income

In explaining this alternative scheme, initially we will ignore factors other than income which may be relevant to the index of equality. The first point to note about Figure VI-1 is the treatment of individuals whose income is equal to or less than a "subsistence" level. These individuals are considered to have such low incomes that their deductible is zero. Hence, if we designate Y_0 as the "subsistence" income level, then the horizontal axis in Figure VI-1 is applicable to individuals with income less than or equal to Y_0 .

For individuals with incomes in excess of Y_0 , the deductible is positive and increases with income. The individual with income level Y_1 in Figure VI-1 has a deductible of OH. Thus, for damage up to and including an amount of OH, the portion OA of the 45° line OV is relevant. For damage in excess of this amount, the relevant graph is AB. The amount of government relief is then given by the vertical distance between AB and AV for any given level of asset damage. The individual with income level Y_2 in Figure VI-1 where Y_2 exceeds Y_1 has a higher deductible than the individual with income level Y_1 .

It can also be seen from Figure VI-1 that a higher-income individual can only bear a smaller value of damage himself than a lower-income individual if his total damage is less than that borne by the lower-income individual. For example, suppose the Y_2 individual is at point J in Figure VI-1. He is bearing the full value of his damage himself although this may be less than

that borne by the lower-income person Y_1 . Unless Y_2 is made to contribute into the scheme, this situation cannot be rectified.¹ The alternative scheme is thus based upon the outcome of our theoretical analysis that individuals with equal incomes should bear no more than some specified maximum value of damage themselves and that this maximum should be positively related to income.

The alternative scheme may be illustrated in a slightly different form by depicting the value of damage borne by the applicant (or the deductible) as a function of income. This illustration is presented in Figure VI-2. For individuals with incomes less than or equal to Y_0 , the deductible is zero. As income increases beyond Y_0 , the deductible is positively related to income. It should not be thought that all individuals will fall somewhere on the graph. They will only do so if the total value of their damage exceeds the deductible. Otherwise, they will fall somewhere in the shaded area bounded by the positively-sloped section of the graph and the horizontal axis.

It will be recalled that the theoretical analysis of Chapter IV gave no indication as to the appropriate rate structure in terms of the behaviour of the deductible as a proportion of income. Given the assumptions of Chapter IV, the most we can specify is that the deductible should be positively related to income. The additional problem of determining the rate structure can be clarified with reference to Figure VI-2.

The scheme as presented in Figure VI-2 is specified by the following equations:

$$\text{For } Y \leq Y_0, \quad D - G = 0 \quad (1)$$

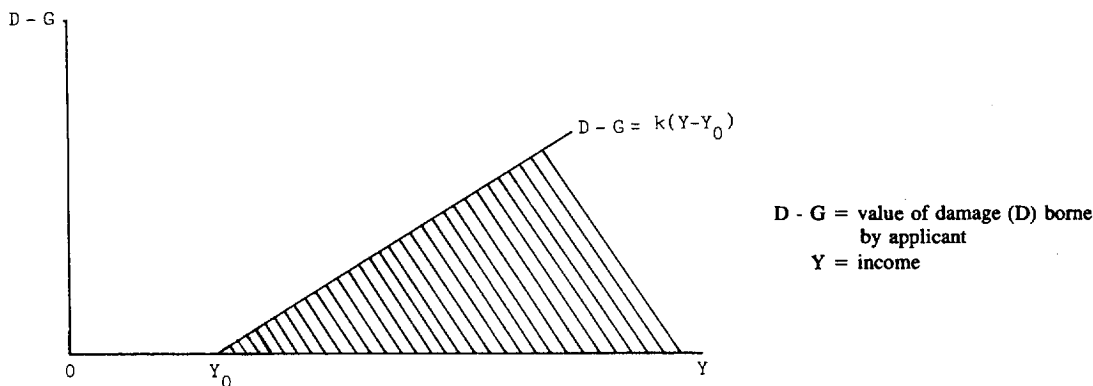
$$\text{For } Y > Y_0, \quad D - G = D, \quad D \leq k(Y - Y_0) \quad (2)$$

$$D - G = k(Y - Y_0), \quad D > k(Y - Y_0) \quad (3)$$

Equation (1) refers to individuals with an income level equal to or less than the "subsistence" level and requires no further explanation. Equation (2) states that, when an individual's total damage is less than his deductible, he bears the full amount of the damage himself. Equation (3) states that, when an individual's total damage exceeds his deductible, he bears only the amount of the deductible.

Figure VI-2

**VALUE OF DAMAGE BORNE BY APPLICANT AS A FUNCTION OF INCOME
— AN ALTERNATIVE SCHEME**



The rate structure is determined by reference to equation (3), which expresses the deductible as a function of income. The marginal deductible rate (MDR) and average deductible rate (ADR) are obtained as follows:

$$\text{MDR} = \frac{d(D - G)}{dY} = k$$

$$\text{ADR} = \frac{D - G}{Y} = k\left(1 - \frac{Y_0}{Y}\right).$$

¹ The point made in Chapter V, n.33 is also of relevance here.

MDR is constant and independent of income while ADR increases as income increases above Y_0 . The scheme thus appears to have a progressive rate structure, although this progression arises simply because of the use of a subsistence income level. The scheme actually has a proportional rate structure for incomes in excess of the subsistence level Y_0 .²

The foregoing algebraic specification of the scheme is not the only possible specification. Another example would be a deductible/income relationship of the following form:

$$D - G = k(Y - Y_0)^2$$

$$\text{MDR} = 2k(Y - Y_0)$$

$$\text{ADR} = kY - 2kY_0 + \frac{kY_0^2}{Y}$$

This would give a fully progressive rate structure, with MDR and ADR increasing as income increases, rather than the "degressive" rate structure arising from the previous specification.

It can be seen that, regardless of the precise specification, the "policy parameters" which must be determined by the government are the subsistence income level Y_0 and the constant k which is the multiplicative factor between income in excess of subsistence and the deductible. Once the general form of the deductible/income relationship is decided upon, the values attached to these two parameters will determine the marginal and average deductible rates.

It may appear that this alternative scheme places an open-ended expenditure commitment on the government. However, this is not necessarily so. If the government wishes to impose an overall expenditure constraint, it can attach values to Y_0 and k that will limit total grants to individuals accordingly. Ideally, a breakdown of damage by income levels would enable a precise determination of Y_0 and k to exhaust the budget. In reality, such a breakdown of damage would be unavailable and some "educated guesses" would need to be made. Nevertheless, it should be possible to place values on Y_0 and k which constrain expenditure to within the limits required.

(2) The Problem of Moral Hazard

The foregoing scheme, which may be described as a compulsory natural disaster insurance scheme incorporating equitable deductibles, satisfies the principles of efficiency and equity in taxation. There is, however, another aspect of efficiency in resource allocation which we have so far ignored. This aspect of efficiency relates to the problem of moral hazard in insurance. Ideally, when an individual is covered by insurance, the insured event, whatever it may be, should be outside the control of the individual. In other words, the individual by his actions should not be able to affect the probability of the insured event occurring. In reality, this is rarely the case. In terms of flood insurance, for example, the probability of an individual suffering damage is influenced by his locational decisions. He is clearly more likely to suffer damage if he locates on a flood plain rather than on a hilltop.

In private sector insurance markets, these adverse incentive effects of insurance can be taken into account in determining premiums. Any action which an individual takes which increases the probability of the event occurring can be reflected in the premium which he must pay for cover. This ensures that the marginal benefit which the individual derives from his action is at least equal to the expected marginal cost of his action. This will lead to an efficient allocation of resources because, as a result of risk-discrimination in premiums, an individual will not use resources in any activity where the marginal benefit he obtains is not at least equal to the expected marginal cost of using those resources. Hence Arrow's statement that "insurance requires for its full social benefit a maximum possible discrimination of risks".³

We have not yet examined the implications of a scheme of equitable deductibles for the problem of moral hazard in natural disaster insurance. Our justification for this, as stated in Chap-

² Some writers have referred to such a rate structure in a taxation system as a "degressive" rate structure. See J. M. Buchanan, *The Public Finances*, 3rd edn, Irwin, Homewood, 1970, p.216. The marginal and average deductible rates are not exactly comparable to marginal and average rates of taxation, because the former are based on ratios between a stock concept ($D - G$) and a flow concept (Y). They would, however, be comparable if ($D - G$) was converted to an annual income-equivalent (see Chapter IV, n.35) and expressed as a proportion of income.

³ K. J. Arrow, "Uncertainty and the Welfare Economics of Medical Care", *American Economic Review*, Vol. 53, No. 5, December 1963, reprinted in M. H. Cooper and A. J. Culyer (eds), *Health Economics*, Penguin, Harmondsworth, 1973, p.37.

ter IV, is that this problem was not particularly relevant to the relief schemes for individuals which we have evaluated. The operation of the relief schemes was not announced until after the disaster had occurred. Because the Australian Government had given assistance directly to individuals on only one previous occasion (the 1967 bushfires in Tasmania), it was unlikely that people would have anticipated government assistance with any degree of certainty. Hence, it seems most unlikely that the schemes would have given rise to the problem of moral hazard.

If the alternative scheme were to be used on a continuing basis, the problem of moral hazard could not be ignored. The scheme would be financed from taxation, so there would be no risk-discrimination in the "premiums". Similarly, the deductible would be determined solely on the basis of equity, so there would be no risk-discrimination in the distribution of benefits. There would thus be no risk-penalty for locating in "naturally hazardous" areas nor would there be any incentive to undertake "preventive" construction. The alternative scheme would thus be inefficient in this respect.

This source of inefficiency in government relief programs has been recognised by other writers. Kunreuther, in referring to a study of changes in urban occupancy in flood plains in the United States, says that "empirical evidence from the White study indicates that the primary reason why the majority of individuals have moved into flood-plain areas is because they anticipated future flood protection through federal funds".⁴ Hirshleifer, in advocating a war damage insurance scheme with premiums determined on the basis of risk (or vulnerability to enemy bombing), states that "such a schedule of differential rates will, through the price system, tend to encourage voluntary private actions in the direction of reducing vulnerability to bombing".⁵ With regard to government relief schemes to compensate individuals who suffer damage, he argues "that simple compensation programs of this type tend actually to discourage private actions which would reduce vulnerability, thereby increasing the overall national risk".⁶

(3) Risk and Insurance

A further problem arises with the alternative scheme if properties have been purchased at market prices which reflect the relative risk of natural disaster damage. For example, suppose a house on a flood plain sells for \$12,000 whereas a house of similar age and condition in a flood-free area sells for \$20,000. The lower price of the flood-plain house is a reflection of the higher flood risk and the consequent higher premiums which must be paid for flood cover. If the alternative scheme were then introduced, windfall gains and losses would result as market prices adjusted to reflect the availability of cover which was unrelated to risk. The consequent redistributions of wealth are likely to be random and uncertain.

There are generally two ways in which risk considerations can be taken into account. First, the scheme itself may superimpose risk-discrimination on the determination of equitable deductibles. Secondly, the government may wish to encourage individuals to buy cover from private insurance firms which risk-discriminate. We will discuss each of these alternatives in turn.

The alternative scheme could introduce ex-post risk-discrimination in the payment of relief by attaching a risk penalty to an individual's deductible if he either purchases an existing dwelling or constructs a new dwelling in an area which is more "naturally hazardous" than the area in which he currently resides. The initial deductibles would be determined solely on the basis of an individual's income as illustrated in Figures VI-1 and VI-2. Thereafter, an individual's deductible would be increased if he moved into a higher-risk area. The result is illustrated in general terms in Figure VI-3. Initially, individuals with an income level Y_1 would all have a deductible of an amount OH regardless of their present location. If, however, after the commencement of the scheme, an individual moves into a higher-risk area, his deductible will increase. The individual now has an associated risk factor R_2 which is greater than his original risk factor R_1 . Another way of viewing this adjustment is to consider locational decisions made after the commencement of the

⁴ H. Kunreuther, "The Case for Comprehensive Disaster Insurance", *The Journal of Law and Economics*, Vol. XI, April 1968, p.134.

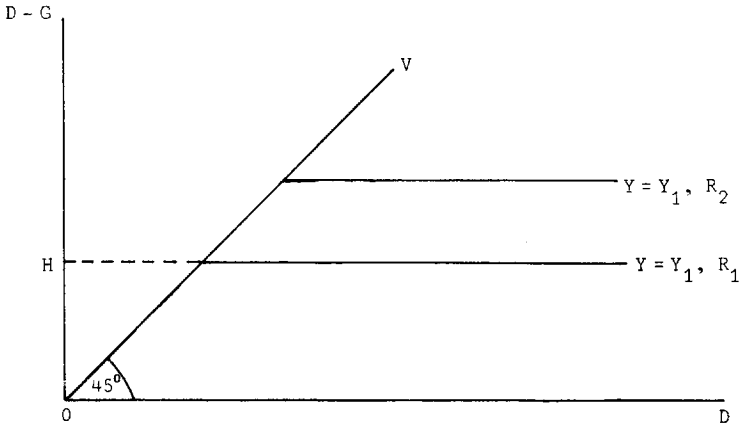
⁵ J. Hirshleifer, "War Damage Insurance", *Review of Economics and Statistics*, Vol. 35, No. 2, May 1953, p. 146.

⁶ *Ibid* (emphasis in original).

scheme as being relevant to the index of equality. In Figure VI-3, the individual who chooses a location with a higher-risk factor than his present location is deemed no longer to be equal to others of the same income level but rather to be equal to individuals on some higher income level. The scheme will then contain a financial incentive not to move into higher-risk areas.

Figure VI-3

EQUITABLE DEDUCTIBLES ALLOWING FOR EX POST RISK-DISCRIMINATION



D - G = value of damage (D) borne by applicant
Y = income
R = risk factor

It is possible that individuals will react to this state of affairs by purchasing private insurance cover equal to the amount of their deductible. However, this will not undermine the risk-discrimination in the scheme if private insurance firms charge risk-discriminating premiums. Thus the individual in Figure VI-3 with risk factor R₂ will have to pay a higher premium for coverage of his (higher) deductible than he would have paid had he not moved into a higher-risk area.

The second way in which risk considerations can be taken into account is for the government to build into the scheme an incentive for individuals to buy cover from private insurance firms. The scheme itself will then contain no element of risk-discrimination. There are two ways in which this may be achieved. First, the government may simply choose values for the policy parameters Y₀ and k so that the deductible increases steeply with income. In particular, the lower the value of Y₀ and the higher the value of k, the larger will be the deductible for any given income level. For example, the values of the parameters may be designed to give the average income earner a deductible of \$10,000. This will give such an individual a distinct incentive to buy cover against his deductible. If he does so, risk considerations will exert their influence through the premium.

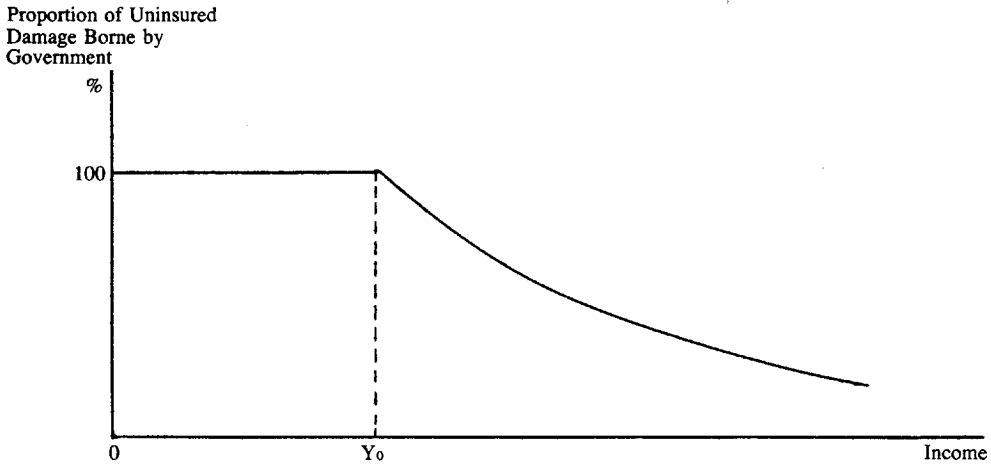
This possibility presents a way in which private insurance firms may provide cover against disasters which they have previously considered "uninsurable". Consider, for example, the case of flood insurance. The reasons why this type of coverage is not usually offered are neatly summarised in the following quotation from the staff report for the U.S. Senate Banking and Currency Committee in 1956:

"Because of the virtual certainty of the loss and its catastrophic nature and the impossibility of making this line of insurance self-supporting due to refusal of the public to purchase such insurance at the rates which would have to be charged to pay annual losses, companies generally could not prudently engage in this field of underwriting."⁷

⁷ Cited in Kunreuther, *op. cit.*, p. 149.

Figure VI-4

CO-INSURANCE RATES ON UNINSURED DAMAGE AS A FUNCTION OF INCOME



If individuals were to take out cover against their deductible, the limit on the insurance company's payouts would be well defined. The problem of low-income groups not being able to afford cover would also be solved because of the equitable deductible. An adjustment to the scheme to make allowance for risk considerations thus represents a viable alternative to government provision of reinsurance facilities to private insurance firms coupled with subsidised premiums, as advocated by Dacy and Kunreuther.⁸ A similar scheme for Australia is under consideration at the time of writing.⁹

The second way in which the government may give individuals an incentive to buy private cover is through the use of an income-related co-insurance provision on uninsured damage rather than an equitable deductible. The government would give an individual a grant equal to some given proportion of his uninsured damage, the proportion declining as income increased. This relationship between income and the co-insurance rate is illustrated in Figure VI-4. Individuals with income equal to or less than Y_0 (the "subsistence" level) have 100 per cent of uninsured damage covered by the government. Clearly, there is no incentive for such individuals to buy private cover. As income increases in excess of Y_0 , the percentage of uninsured damage borne by the government decreases. For some given income level in excess of Y_0 and some given damage level, the individual will bear a higher value of damage himself in absolute terms the less insurance cover he purchases. He thus has an incentive to take private cover, and this incentive will then become stronger as his income increases.¹⁰

It is clear that this alternative will lead to a violation of the equity criteria derived in Chapter IV. The equitable deductible is dispensed with in favour of an income-related co-insurance rate on uninsured damage. There is, however, an efficiency gain in that individuals are given an incentive to take out private cover, the premiums for such cover being based upon risk considerations.

We have so far discussed the polar case of an alternative "pure equity" scheme and considered some modification to this scheme to allow for efficiency considerations concerning risk-discrimination. Before we conclude the discussion, it is worthwhile for comparative purposes to outline a "pure efficiency" scheme. Such a scheme will incorporate risk-discrimination in the

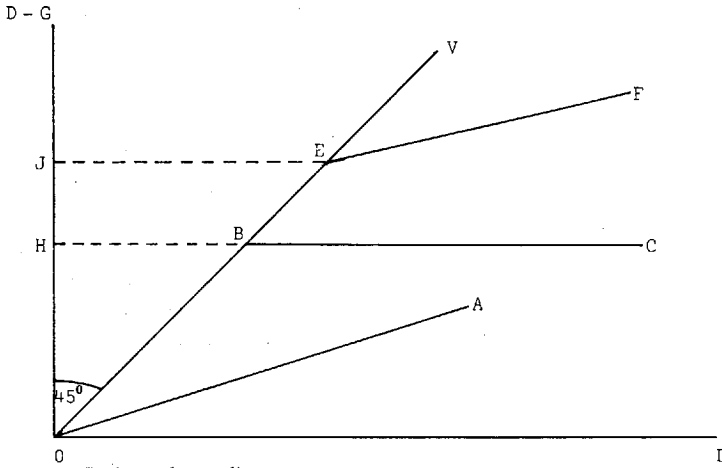
⁸ D. C. Dacy and H. Kunreuther, *The Economics of Natural Disasters*, The Free Press, New York, 1969, Chapter 12. See also H. Kunreuther, *op. cit.*, pp. 154-61.

⁹ Australian Treasury, *A Natural Disaster Insurance Scheme for Australia: A Discussion Paper*, A.G.P.S., Canberra, 1976.

¹⁰ The Australian Government applied a non-income-related co-insurance rate to uninsured damage in distributing grants to victims of cyclone "Tracy" in Darwin in December 1974. See Department of Social Security, *Darwin Cyclone Damage Compensation Act: Report for the Year Ended 30 June 1976*, Acting Commonwealth Government Printer, Canberra, 1977, p. 3.

Figure VI-5

CO-INSURANCE, DEDUCTIBLE AND CO-INSURANCE/DEDUCTIBLE PROVISIONS UNRELATED TO RISK OR INCOME



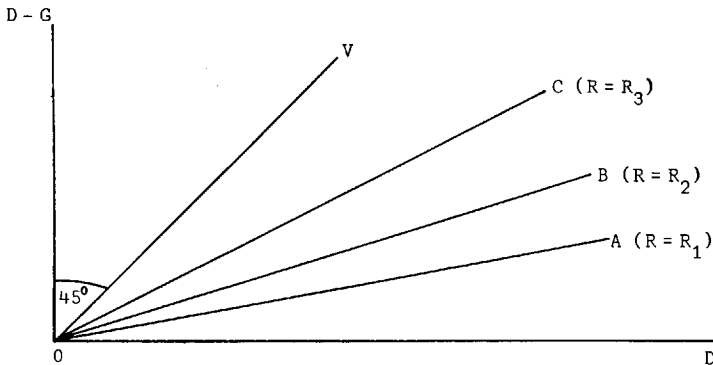
$D - G$ = value of damage (D) borne by applicant

determination of premiums and may use co-insurance and/or deductible provisions with respect to benefits. If these provisions are used, they may be risk-related but will not be related to income. Figure VI-5 illustrates a co-insurance provision, a deductible provision and a combined co-insurance/deductible provision all of which are not risk-related. The value of damage borne by an individual ($D - G$) is measured on the vertical axis and damage (D) is measured on the horizontal axis. Let us consider two extreme cases. First, a person who takes no cover at all will bear the full cost of damage and be at some point on the 45° line OV. The second extreme case is a person who takes full cover for asset damage. Such a person will bear no cost himself and hence ($D - G$) will be zero. He will then be at some point on the horizontal axis.

The co-insurance provision is represented by the line OA, the slope of the line being determined by the co-insurance rate. In the absence of risk- or income-discrimination, the same co-insurance rate will be applied to all insureds. The deductible provision is illustrated by the graph OBC, the amount of the deductible being OH. A combined co-insurance/deductible provision is

Figure VI-6

CO-INSURANCE RATES RELATED TO RISK BUT UNRELATED TO INCOME



$D - G$ = value of damage (D) borne by applicant
 R = risk factor

represented by the line OEF, the amount of the deductible being OJ. In these cases also the same graph will be applicable to all insureds in the absence of risk- or income-discrimination.¹¹

Co-insurance and/or deductible provisions which are risk-related but not income-related may be illustrated by a diagram similar to Figure VI-5. A set of risk-related co-insurance rates is depicted in Figure VI-6. As the risk factor increases from R_1 to R_2 and beyond, the co-insurance rate increases, i.e. the individual has to bear a larger proportion of the damage himself. Similar graphs could be presented for risk-related deductible and combined co-insurance/deductible provisions.

Another difference between the "pure efficiency" scheme provided in the private sector and the alternative scheme presented here relates to the question of compulsion. The alternative scheme would be financed from taxation, so that no individual would have the option of not buying cover. The "pure efficiency" scheme would be financed by voluntary contributions which individuals would make to private insurance companies in return for cover. The effect of a compulsory scheme is to share the costs of the disaster over all taxpayers. The voluntary scheme spreads the insured costs only over those who choose to contribute to the scheme, uninsured costs being borne entirely by the natural disaster victim. This point of difference raises some difficult questions which we will not pursue in this monograph.

(4) Conclusion

In concluding, we discuss briefly some administrative aspects of implementing the alternative scheme. With regard to the concept of income to be adopted as the index of equality, i.e. the "tax base", it is unlikely that a comprehensive definition could be adopted in practice. The "second best" alternative would appear to be the concept of taxable income as used for personal income taxation in Australia. Once individuals' damage claims have been verified by, for example in the case of damage to dwellings, building inspectors from the relevant State Departments of Housing, these claims could be forwarded to the Australian Taxation Office for determination of the grants.

The concept of taxable income currently employed in Australia does not contain an allowance for dependants, such an allowance now being made through a tax rebate. However, it is relatively easy to calculate the tax-deduction-equivalent of the rebate for the purpose of establishing comparability between the taxable income of taxpayers with and without dependants. The tax-deduction-equivalent of the rebate may then be subtracted from the person's taxable income in determining the deductible as in Figure VI-1. Therefore the other factors usually considered relevant to the index of equality may be incorporated into the alternative scheme without difficulty.

¹¹ The co-insurance provisions need not necessarily be applied to total damage. The co-insurance rate may be applied to damage up to a certain amount after which full cover is provided. In this case, the lines OA and EF in Figure VI-5 will become horizontal on reaching the damage limit.

Appendix A

SOME CONSIDERATIONS RELATING TO THE USE OF NET WORTH IN MEANS TESTS

In Chapter V, we criticised the use of components of wealth (or net worth) in the implementation of the Personal Distress and Hardship and the Housing Repair and Rebuilding Assistance schemes. We pointed out that the definitions of wealth used in the means tests for these two schemes were not precise. With regard to the Personal Distress and Hardship scheme, wealth was defined at one point as "bank balances, investments, and other negotiable assets" and at another point as "bank balances and/or cash investments". In the Housing Repair and Rebuilding scheme, wealth (or "net realisable assets") was defined as "the applicant's bank balances and/or cash investments". We were also told that, in the operation of this scheme, the concept of wealth specifically excluded "the value of land on which the residence was situated". It is clear that in both schemes only relatively liquid assets were included in the definitions of wealth employed.

In this appendix we develop our critique of the use of wealth or net worth as a means test for distributing assistance following a natural disaster, or indeed for any other purpose. In particular we indicate that to concentrate attention on applicants' holdings of financial assets, particularly those which are liquid and which are relatively easy to identify and check as seemed to be emphasised in the *Authorization and Determination*, will lead to inequity in the administration of assistance for flood victims.

We begin by conceptualising the issues associated with the holding of wealth. To calculate the wealth or net worth of a person it is necessary to draw up a balance sheet. Assets will (typically) include a house, contents and personal belongings, a car, cash, bank deposits and other financial assets; liabilities will almost certainly relate to loans for the purchase of a house and other consumer durables. The difference between the person's assets and liabilities is defined as *personal net worth*.¹

If we add the personal net worth of all individuals in the country we will obtain a figure for *total personal net worth*. In the course of undertaking such an exercise many items will be cancelled. What will remain after all such cancellations will be physical assets (as defined) and the financial claims of persons on other sectors of the economy, for example banks, companies, government and the rest of the world. There will also be a total of personal financial liabilities.

However, *total personal net worth* is not identical to *total national net worth*. To measure the latter concept it is necessary to determine two other phenomena: the net worth of the company sector and the net worth of the government sector. It might be thought that the net worth of the company sector could be determined by the value of shares (which have been included in the calculation of personal net worth) as determined by the stock market, and hence that the company sector has no independent net worth. However, Revell has shown that the total net value of company assets exceeds the total stock market value of company shares.² The reason for this is that the stock market prices of companies represent company values to the "marginal" shareholder and most shareholders are not prepared to sell their shares at the prevailing market prices, for a variety of reasons.³

The government sector, including all levels of government and public enterprises, may conceivably have either a positive or negative net worth. The net worth position of this sector depends on whether its capital formation and current expenditure have on balance been financed from taxation revenue or by issuing bonds to the private sector.

Atkinson has calculated these data for Britain in 1966. We reproduce as Table A-1 his table indicating the relationship between the three concepts.

¹ For an overview of these issues see A. B. Atkinson, *The Economics of Inequality*, Oxford University Press, Oxford, 1975, Chapters 7 and 8; and A. B. Atkinson, *Unequal Shares: Wealth in Britain*, rev. edn, Penguin, Harmondsworth, 1974, Chapter 1.

² J. R. S. Revell, *The Wealth of the Nation*, Cambridge University Press, Cambridge, 1967.

³ It is because of such considerations that a company attempting a take-over of a firm typically offers the firm's shareholders a premium above the existing stock market price.

Table A-1
COMPONENTS OF TOTAL NATIONAL WEALTH^a, BRITAIN, 1966

Concept of Wealth	£ million
Total Personal Net Worth	107,000
Net Worth of Company Sector	25,000
Net Worth of Public Sector	6,000
Total National Wealth	138,000

Note: ^a Excluded from this table are assets of trade unions, church bodies, etc.

Source: A. B. Atkinson, *Unequal Shares: Wealth in Britain*, rev. edn, Penguin, Harmondsworth, 1974, p.8.

Thus total personal net worth is only a part, although a major part, of total national wealth. In the case of Britain in 1966 it represented 77.5 per cent of total national wealth. And it is clear from what we have said previously that financial assets are only a part of total personal net worth. Of total personal net worth (£107,000 million) indicated in Table A-1, £56,500 million or 52.80 per cent was represented by financial assets.

No study of national wealth in Australia has been undertaken. However, since Knibbs's study of personal wealth⁴ only two other studies of this part of national wealth have been undertaken to our knowledge, namely the work of Kakwani and Podder⁵ and that of Gunton.⁶ The former is based on survey data⁷ and the latter is derived from the application of the estate multiplier method⁸ to data provided by the various State and Australian Government departments which administer death duties and gift taxes. To put it mildly, our knowledge of non-human wealth in Australia and of its distribution is not extensive. This very fact would give rise to concern in using wealth as a tax base⁹ or, our particular concern in this monograph, as a mechanism for implementing means tests. In the Australian context, it can be argued that Gunton's study, which employs the estate multiplier method, is likely to be more reliable than the study based on the 1963-65 and 1966-68 surveys because of the under-representation of rural assets in those surveys.

Given the nature of the classification of data employed in administering death duties and gift taxes in Australia, the only classification of wealth that we have is in terms of realty and personalty, where the latter term includes all wealth other than real estate.¹⁰ However we know from overseas studies that the asset portfolios of persons in different net worth positions are not uniform. That is to say, different types of assets are held by people in different net worth positions or occupational groups in quite different ways. Revell found that persons in Britain with low net worth tended to hold a greater proportion of their wealth in the form of cash and deposits with banks and building societies than did persons with greater net worth. Persons with low net worth held virtually none of their wealth in the form of company shares.¹¹ Lydall and Tipping reached

⁴ G. H. Knibbs, *The Private Wealth of Australia and Its Growth*, Commonwealth Bureau of Census and Statistics, Melbourne, 1918.

⁵ N. C. Kakwani and N. Podder, "Distribution of Wealth in Australia", Department of Econometrics, University of New South Wales, Sydney, *mimeo.*, 1973.

⁶ R. Gunton, *Personal Wealth in Australia 1953-1969*, Unpublished Ph.D. thesis, University of Queensland, Brisbane, 1975.

⁷ H. R. Edwards and R. C. Gates, "Survey of Consumer Finances, Sydney 1963-65", *mimeo.*, 1966; and N. T. Drane, H. R. Edwards and R. C. Gates, "The Australian Survey of Consumer Expenditures and Finances, 1966-68", *mimeo.*, 1969.

⁸ For an exposition of this method see H. F. Lydall and D. G. Tipping, "The Distribution of Personal Wealth in Britain", reprinted in A. B. Atkinson (ed.), *Wealth, Income and Inequality: Selected Readings*, Penguin, Harmondsworth, 1973, pp.243-67; and Atkinson, *Unequal Shares: Wealth in Britain*, *op. cit.*, pp.10-14.

⁹ For some administrative reservations see Australian Treasury, *Net Wealth Taxes*, A.G.P.S., Canberra, 1974.

¹⁰ To give an indication of the paucity of information on wealth, we point out that it is only since 1956 that we have a disaggregation of personal wealth in Australia by industry and only since 1968 that personal wealth is disaggregated by State. See Gunton, *op. cit.*, Chapters 8 and 10.

¹¹ J. R. S. Revell, "Assets and Age", *Bulletin of the Oxford Institute of Economics and Statistics*, Vol. 24, August 1962, Table II.

similar conclusions in their study.¹² Lydall and Lansing found a similar pattern for the United States and Britain using an occupational classification.¹³

Thus it is not unreasonable to conclude that the emphasis placed on liquid assets in the *Authorization and Determination of the Queensland Flood Relief Act 1974* had the effect of making the means test on "net realisable assets" bite more severely on people with low net worth than on those with high net worth.

We shall now consider in more detail some matters concerning the holdings of financial assets, which means that we are concerned with only a *part* of personal net worth. Financial assets consist of cash, shares, debentures, bonds, inscribed stock or notes issued, and deposits accepted, by business firms, financial institutions and the government. We will concentrate our attention on a *part* of all financial assets, namely financial assets of persons represented by claims on (liabilities of) governments and financial intermediaries. The most important omission is company shares.

We consider first some selected liabilities from the aggregated balance sheets of some major financial institutions in Australia. The financial institutions and the liabilities items are listed in Table A-2. The liabilities marked with an asterisk will be considered shortly.

Of all the liabilities of the financial intermediaries listed in Table A-2, the ones in which we are interested are those relating to the formation of *financial assets*, i.e. assets created by the provision of finance. The financing process is essentially a mechanism by which economic units with surplus funds transfer those funds to other economic units which desire to spend more than their current disposable income and accumulated cash balances. "Finance permits divergences [between disposable income and spending] by transferring funds from those who spend less than their disposable income to those who spend more . . . Its primary function is to transfer purchasing power."¹⁴ Such financial assets are liabilities from the point of view of the financial intermediary but are assets from the point of view of the person or institution holding them.

Table A-2

SOME LIABILITIES OF FINANCIAL INTERMEDIARIES IN AUSTRALIA

Financial Intermediaries	Titles of Liabilities
Trading Banks	Deposits*
Savings Banks	Deposits*
Other Banking Institutions	Deposits
Life Insurance Offices	Reserves*
Public Pension Funds	Reserves*
Finance Companies	Deposits, Debentures and Notes
General Financiers	Deposits, Debentures and Notes
Money Market Corporations	Debentures, Notes and Deposits
Permanent Building Societies	Deposits and Shares in Co-operatives*
Terminating Building Societies	Deposits and Shares in Co-operatives*
Authorised Money Market Dealers	Deposits
Credit Co-operatives	Deposits and Shares in Co-operatives*
Pastoral Finance Companies	Debentures, Notes and Deposits*

*See text.

Several points should be noted concerning Table A-2. First, the institutions listed there do not comprise an exhaustive list of financial institutions in Australia. The two exceptions are the Reserve Bank of Australia and Non-Life Insurance Offices. Secondly, the terminology and presentation are different from those employed in previous financial flow data prepared by the Reserve Bank of Australia. This is so for two reasons: first, alterations have been made to achieve greater

¹² *Op. cit.*, Tables 4 and 5.

¹³ H. F. Lydall and J. B. Lansing, "A Comparison of the Distribution of Personal Income and Wealth in the United States and Great Britain", in Atkinson (ed.), *op. cit.*, Table 11.

¹⁴ Reserve Bank of Australia, *The Nature and Role of Finance*, Occasional Paper No. 1, Reserve Bank of Australia, Sydney, 1968, pp.6-7.

consistency with the recommendations of the United Nations;¹⁵ secondly, alterations to the institutional classifications have been made to achieve consistency with the categories of financial institutions specified in the *Financial Corporations Act* 1974 of the Australian Parliament.

We are interested in obtaining an estimate of financial assets held by persons. There is little problem in specifying government securities held by persons as the Reserve Bank publishes data on "Government Securities Classified by Holder". Although the other Australian data on this matter are not good,¹⁶ we can obtain a fairly good estimate by excluding deposits of "Other Banking Institutions", non-personal deposits of "Trading Banks", deposits of "Authorised Money Market Dealers", and deposits, debentures and notes of "Finance Companies", "General Financiers" and "Money Market Corporations". In other words we are interested in the liabilities items marked with an asterisk in Table A-2. With the exclusions mentioned above the total of the remaining liabilities items is likely to be close to personal financial assets, excluding government securities. Column (1) of Table A-3 is simply the summation of government securities held by persons and the assets represented by the liabilities items marked with an asterisk in Table A-2 for the period 1964 to 1969.

Table A-3

SOME DATA ON CATEGORIES OF WEALTH IN AUSTRALIA, 1964-69

	Personal Financial Assets ^{ab}	Personal Net Worth ^c	Percentage of Personal Net Worth Held as Financial Assets
	\$ million (1)	\$ million (2)	% (3)
1964	11,805	42,360.6	27.87
1965	13,039	45,271.8	28.80
1966	14,118	50,748.7	27.82
1967	15,462	59,585.8	25.95
1968	16,975	60,252.0	28.17
1969	18,674	71,196.4	26.23

Note: The proportion of total Government Securities held by persons is approximately 8-11 per cent in various years.

Sources: ^a Reserve Bank of Australia, *Statistical Bulletin: Financial Flow Accounts Supplement*, Reserve Bank of Australia, Sydney, 1976, Tables 3.2, 3.3.

^b Reserve Bank of Australia, *Statistical Bulletin*, Reserve Bank of Australia, Sydney, August 1969, p.44.

^c R. Gunton, *Personal Wealth in Australia 1953-1969*, Unpublished Ph.D. thesis, University of Queensland, Brisbane, 1975, Table 9.5.

In column (2) we reproduce some data from Gunton's study¹⁷ of personal wealth in Australia. In column (3) we present the data of column (1) as a percentage of personal net worth (column (2)).

During the period 1964 to 1969 the proportion of total net worth varied from 25.95 per cent to 28.80 per cent. We can contrast these latter percentages with the corresponding figure for Britain in 1966 of 52.80 per cent.¹⁸ At first glance, it might appear that the Australian percentages are wrong by comparison with Britain. However, in their comparisons of the relative importance of various components of net worth in the United States and Britain, Lydall and Lansing found that a much larger proportion of net worth in Britain was held in the form of liquid assets in particular, and financial assets in general, than was the case in the United States.¹⁹ Their explanation for this was that in the United States, a country that is almost thirty-eight times the size of Britain in land area, a much larger proportion of total net worth was held in the form of land, whether it be for homes, farms or other real estate.²⁰ They found that total financial assets rep-

¹⁵ United Nations, *A System of National Accounts*, Studies in Methods, Series F, No. 2, Rev. 3, Statistical Office, Department of Economic and Social Affairs, New York, 1968.

¹⁶ Of all the liabilities items listed in Table A-1 only data on trading bank deposits are disaggregated by holder.

¹⁷ *Op. cit.*

¹⁸ See above.

¹⁹ *Op. cit.*, Table 11.

²⁰ *Ibid.*, pp. 157-8. Another explanation they offered was the difference in social philosophy in the two countries on the matter of public ownership of rental housing.

resented 46 per cent of total personal net worth in Britain in 1954 and only 22 per cent in the United States during 1953.²¹ Unfortunately, these data are not directly comparable to Atkinson's 1966 data²² and the data we have derived for Australia because of differences in the methods of classification. However, they are sufficient to suggest that the data in Table A-3 for Australia, also a land-intensive country, may not be too far wrong.

The conclusion that we draw from this analysis of net worth in Australia is that the readily identifiable items of wealth which were mentioned in the *Authorization and Determination* of the *Queensland Flood Relief Act 1974* to implement the "wealth" means test for assistance under the Personal Distress and Hardship and Housing Repair and Rebuilding schemes, represent only a part, indeed a very small part, of personal net worth for the country as a whole. We may note also that it is much more difficult to detect some of the components of net worth other than financial assets. Such a consideration leads to the conclusion that the extent to which the means test "bites" depends among other things on the honesty of flood relief applicants in declaring the various forms in which they hold their net worth. It is a relatively simple process to check applicants' holdings of certain financial assets, particularly deposits with banks and building societies, whereas holdings of other financial assets and other forms of net worth cannot be readily checked.

We now consider a smaller aspect of the specification of certain financial assets in the *Authorization and Determination*. In the earlier analysis in this appendix we excluded certain liabilities of some major financial institutions in Australia. Our reason for doing so was related to our concern to identify financial assets held by persons so as to make comparisons with total personal net worth. However, in undertaking those exclusions we obscured an important aspect of recent developments in Australian capital markets.

In column (1) of Table A-4 we indicate, for the period from 30 June 1964 to 30 June 1974, the proportion of total liabilities for all the financial intermediaries listed in Table A-2 that was represented by all the liabilities listed in that same table. It is clear that the proportion of total liabilities of all those financial intermediaries that was represented by this variable remained at about 85 per cent during the period, being lowest (83.27 per cent) in 1974 and highest (87.01 per cent) in 1968.

In column (2) we have calculated the percentage of total liabilities of all the financial intermediaries listed in Table A-2 that were represented by deposits with trading and savings banks. During the period 1964 to 1974 this proportion declined from 58.13 per cent to 48.01 per cent; however in the years 1973 and 1974 the percentage increased slightly from the lowest figure of 46.21 per cent in 1972. This is a manifestation of the well known fact that the Australian capital market has become more diverse and flexible since the 1950s.²³ The relative share of financial mediation provided by non-bank financial intermediaries has grown significantly since that time with the development of finance companies providing instalment credit finance for durable consumer goods, the growth of development finance companies, credit unions and building societies, and the establishment of the official short term money market.²⁴

In column (3) of Table A-4 we have calculated the percentage of total liabilities of all the financial intermediaries listed in Table A-2 that is represented by deposits of trading banks, savings banks, permanent building societies and terminating building societies. We have chosen these items because they were specifically mentioned in the *Authorization and Determination*. It is clear from the data in column (3) that, although building societies are part of those non-banking financial intermediaries whose growth since the 1950s has so changed the structure of the Australian capital market, their growth has not been such as to offset the relative decline in the traditional banking system. In 1964 the four financial institutions with which we are concerned accounted for approximately 60 per cent of total financial assets (as defined). However by 1974 the percentage had declined to approximately 55 per cent.

²¹ *Ibid.*, Table 11.

²² Atkinson, *Unequal Shares*, *op. cit.* v.7.

²³ See, for example, the various studies in R. R. Hirst and R. W. Wallace (eds), *The Australian Capital Market*, 2nd edn, Cheshire, Melbourne, 1974.

²⁴ See C. P. Harris, *The Economics of the Financial Sector*, 2nd edn, Cheshire, Melbourne, 1975, Chapters 8 and 15.

Table A-4
PROPORTIONS OF SELECTED^a LIABILITIES TO TOTAL LIABILITIES OF MAJOR^b AUSTRALIAN FINANCIAL INTERMEDIARIES 1964-74

Year Ended 30 June	Selected Liabilities as Percentage of Total Liabilities % (1)	Trading and Savings Bank Deposits as Percentage of Total Selected Liabilities % (2)	Deposits of Trading and Savings Banks, Permanent and Terminating Building Societies as Percentage of Total Selected Liabilities % (3)
1964	87.23	58.13	60.28
1965	86.97	57.78	60.07
1966	86.80	56.79	59.21
1967	86.94	55.74	58.33
1968	87.01	54.53	57.43
1969	86.70	52.88	56.39
1970	85.61	50.37	54.51
1971	85.76	48.16	53.05
1972	85.69	46.21	51.94
1973	85.58	48.01	54.45
1974	83.27	48.01	55.06

Notes: ^a See Table A-2.

^b See Table A-2.

Source: Reserve Bank of Australia, *Statistical Bulletin: Financial Flow Accounts Supplement*, Reserve Bank of Australia, Sydney, 1976, Tables 3.2 and 3.3.

What this means is that the financial assets mentioned in the *Authorization and Determination* represented, at about the time of implementing the various flood damage assistance schemes, slightly over half of the financial assets held with financial intermediaries. Flood relief applicants who happened to hold some net worth in the form of deposits, debentures, notes etc. with some financial intermediary other than a bank or building society are likely to have not included such wealth in their wealth holdings for the purposes of the two assistance schemes. Such a situation leads to inequity in the treatment of applicants who are in all respects in similar economic positions except that they hold their net worth in different forms. Also there will be inequity in the treatment of applicants in different economic positions, because the means tests will not be applied consistently as between people who hold wealth in different forms.

Appendix B

FORMULAE FOR DETERMINING VALUE OF DAMAGE BORNE BY APPLICANTS OTHER THAN MARRIED COUPLES WITHOUT DEPENDANTS

This appendix contains seven tables which present the formulae for damage borne by all types of applicant other than married couples without dependants. As with Table V-13 in the text, the tables in this appendix are derived directly from the relevant tables in Section (1) of Chapter V by inserting the formula for G into the expression $(D - G)$.

Table B-1

FORMULAE FOR DETERMINING VALUE OF DAMAGE BORNE BY THE APPLICANT — SINGLE PERSONS WITHOUT DEPENDANTS (S) — PERSONAL DISTRESS AND HARDSHIP ASSISTANCE

<u>Case 1</u>	$\left. \begin{array}{l} Y \leq 100 \\ W \leq 1,000 \end{array} \right\} \begin{array}{l} D - G = 0, \\ D - G = D - 400, \end{array}$	$\begin{array}{l} D \leq 400 \\ D > 400 \end{array}$
<u>Case 2</u>	$\left. \begin{array}{l} 100 < Y < 133.33 \\ W \leq 1,000 \end{array} \right\} \begin{array}{l} D - G = .03(Y - 100)D, \\ D - G = D - 400 + .03(Y - 100)400, \end{array}$	$\begin{array}{l} D \leq 400 \\ D > 400 \end{array}$
<u>Case 3</u>	$\left. \begin{array}{l} Y \leq 100 \\ 1,000 < W < 1,400 \end{array} \right\} \begin{array}{l} D - G = D, \\ D - G = (W - 1,000), \\ D - G = D - 400 + (W - 1,000), \end{array}$	$\begin{array}{l} D \leq (W - 1,000) \\ (W - 1,000) < D \leq 400 \\ D > 400 \end{array}$
<u>Case 4</u>	$\left. \begin{array}{l} 100 < Y < 133.33 \\ 1,000 < W < 1,400 \end{array} \right\} \begin{array}{l} D - G = D, \\ D - G = .03(Y - 100)D + (W - 1,000), \\ D - G = D - 400 + .03(Y - 100)400 + (W - 1,000), \end{array}$	$\begin{array}{l} D \leq \frac{(W - 1,000)}{(4 - .03Y)} \\ \frac{(W - 1,000)}{(4 - .03Y)} < D \leq 400 \\ D > 400 \end{array}$

D - G = value of damage borne by applicant
Y = gross weekly income
W = wealth (as defined for this purpose)

Source: Derived by authors.

Table B-2

FORMULAE FOR DETERMINING VALUE OF DAMAGE BORNE BY THE APPLICANT — SINGLE PERSONS WITH DEPENDANTS (SDe) — PERSONAL DISTRESS AND HARDSHIP ASSISTANCE

Case 9	$\left. \begin{array}{l} Y \leq 100 + 8N \\ W \leq 1,000 \end{array} \right\} \begin{array}{l} D - G = 0, \\ D - G = D - 400, \end{array} \quad \begin{array}{l} D \leq 400 \\ D > 400 \end{array}$
Case 10	$\left. \begin{array}{l} 100 + 8N < Y < 133.33 + 8N \\ W \leq 1,000 \end{array} \right\} \begin{array}{l} D - G = .03[Y - (100 + 8N)] D, \\ D - G = D - 400 + .03[Y - (100 + 8N)] 400, \end{array} \quad \begin{array}{l} D \leq 400 \\ D > 400 \end{array}$
Case 11	$\left. \begin{array}{l} Y \leq 100 + 8N \\ 1,000 < W < 1,400 \end{array} \right\} \begin{array}{l} D - G = D, \\ D - G = (W - 1,000), \\ D - G = D - 400 + (W - 1,000), \end{array} \quad \begin{array}{l} D \leq (W - 1,000) \\ (W - 1,000) < D \leq 400 \\ D > 400 \end{array}$
Case 12	$\left. \begin{array}{l} 100 + 8N < Y < 133.33 + 8N \\ 1,000 < W < 1,400 \end{array} \right\} \begin{array}{l} D - G = D, \\ D - G = .03[Y - (100 + 8N)] D + (W - 1,000), \\ D - G = D - 400 + .03[Y - (100 + 8N)] 400 + (W - 1,000), \end{array} \quad \begin{array}{l} D \leq \frac{(W - 1,000)}{(4 - .03Y + .24N)} \\ \frac{(W - 1,000)}{(4 - .03Y + .24N)} < D \leq 400 \\ D > 400 \end{array}$

D - G = value of damage borne by applicant
Y = gross weekly income
W = wealth (as defined for this purpose)
N = number of dependants

Source: Derived by authors.

Table B-3

FORMULAE FOR DETERMINING VALUE OF DAMAGE BORNE BY THE APPLICANT — MARRIED COUPLES WITH DEPENDANTS (MDe) — PERSONAL DISTRESS AND HARDSHIP ASSISTANCE

Case 13	$\left. \begin{array}{l} Y \leq 140 + 8N \\ W \leq 1,000 \end{array} \right\} \begin{array}{l} D - G = 0, \\ D - G = D - 1,200, \end{array}$	$\begin{array}{l} D \leq 1,200 \\ D > 1,200 \end{array}$
Case 14	$\left. \begin{array}{l} 140 + 8N < Y < 173.33 + 8N \\ W \leq 1,000 \end{array} \right\} \begin{array}{l} D - G = .03[Y - (140 + 8N)] D, \\ D - G = D - 1,200 + .03[Y - (140 + 8N)] 1,200, \end{array}$	$\begin{array}{l} D \leq 1,200 \\ D > 1,200 \end{array}$
Case 15	$\left. \begin{array}{l} Y \leq 140 + 8N \\ 1,000 < W < 2,200 \end{array} \right\} \begin{array}{l} D - G = D, \\ D - G = (W - 1,000), \\ D - G = D - 1,200 + (W - 1,000), \end{array}$	$\begin{array}{l} D \leq (W - 1,000) \\ (W - 1,000) < D \leq 1,200 \\ D > 1,200 \end{array}$
Case 16	$\left. \begin{array}{l} 140 + 8N < Y < 173.33 + 8N \\ 1,000 < W < 2,200 \end{array} \right\} \begin{array}{l} D - G = D, \\ D - G = .03[Y - (140 + 8N)] D + (W - 1,000), \\ D - G = D - 1,200 + .03[Y - (140 + 8N)] 1,200 + (W - 1,000), \end{array}$	$\begin{array}{l} D \leq \frac{(W - 1,000)}{(5.2 - .03Y + .24N)} < D \leq 1,200 \\ D > 1,200 \end{array}$

D - G = value of damage borne by applicant

Y = gross weekly income of the couple

W = wealth (as defined for this purpose)

N = number of dependants

Source: Derived by authors.

Table B-4

FORMULAE FOR DETERMINING VALUE OF DAMAGE BORNE BY THE APPLICANT — SINGLE PERSONS WITH EMPLOYED CHILDREN LIVING AT HOME (SZ) — PERSONAL DISTRESS AND HARSHIP ASSISTANCE

Case 17	$Y + .25 \sum_{i=1}^Z Y_i \leq 100$	$D - G = 0,$	$D \leq 400$
	$W \leq 1,000$	$D - G = D - 400,$	$D > 400$
Case 18	$100 < Y + .25 \sum_{i=1}^Z Y_i < 133.33$	$D - G = .03(Y + .25 \sum_{i=1}^Z Y_i - 100)D,$	$D \leq 400$
	$W \leq 1,000$	$D - G = D - 400 + .03(Y + .25 \sum_{i=1}^Z Y_i - 100)400,$	$D > 400$
Case 19	$Y + .25 \sum_{i=1}^Z Y_i \leq 100$	$D - G = D,$	$D \leq (W - 1,000)$
	$1,000 < W < 1,400$	$D - G = (W - 1,000),$	$(W - 1,000) < D \leq 400$
		$D - G = D - 400 + (W - 1,000),$	$D > 400$
Case 20	$100 < Y + .25 \sum_{i=1}^Z Y_i < 133.33$	$D - G = D,$	$D \leq \frac{(W - 1,000)}{(4 - .03Y - .0075 \sum_{i=1}^Z Y_i)}$
	$1,000 < W < 1,400$	$D - G = .03(Y + .25 \sum_{i=1}^Z Y_i - 100)D + (W - 1,000),$	$\frac{(W - 1,000)}{(4 - .03Y - .0075 \sum_{i=1}^Z Y_i)} < D \leq 400$
		$D - G = D - 400 + .03(Y + .25 \sum_{i=1}^Z Y_i - 100)400 + (W - 1,000),$	$D > 400$

D - G = value of damage borne by applicant

Y = gross weekly income of parent

Y_i = gross weekly income of ith. employed child living at home

W = wealth (as defined for this purpose)

Z = number of employed children living at home

Source: Derived by authors.

Table B-5

FORMULAE FOR DETERMINING VALUE OF DAMAGE BORNE BY THE APPLICANT — MARRIED COUPLES WITH EMPLOYED CHILDREN LIVING AT HOME (MZ) — PERSONAL DISTRESS AND HARSHIP ASSISTANCE

Case 21	$Y + .25 \sum_{i=1}^Z Y_i \leq 140$	$D - G = 0,$	$D \leq 1,200$
	$W \leq 1,000$	$D - G = D - 1,200,$	$D > 1,200$
Case 22	$140 < Y + .25 \sum_{i=1}^Z Y_i < 173.33$	$D - G = .03(Y + .25 \sum_{i=1}^Z Y_i - 140)D,$	$D \leq 1,200$
	$W \leq 1,000$	$D - G = D - 1,200 + .03(Y + .25 \sum_{i=1}^Z Y_i - 140)1,200,$	$D > 1,200$
Case 23	$Y + .25 \sum_{i=1}^Z Y_i \leq 140$	$D - G = D,$	$D \leq (W - 1,000)$
	$1,000 < W < 2,200$	$D - G = (W - 1,000),$	$(W - 1,000) < D \leq 1,200$
Case 24	$140 < Y + .25 \sum_{i=1}^Z Y_i < 173.33$	$D - G = D,$	$D \leq \frac{(W - 1,000)}{(5.2 - .03Y - .0075 \sum_{i=1}^Z Y_i)}$
	$1,000 < W < 2,200$	$D - G = .03(Y + .25 \sum_{i=1}^Z Y_i - 140)D + (W - 1,000),$	$\frac{(W - 1,000)}{(5.2 - .03Y - .0075 \sum_{i=1}^Z Y_i)} < D \leq 1,200$
		$D - G = D - 1,200 + .03(Y + .25 \sum_{i=1}^Z Y_i - 140)1,200 + (W - 1,000),$	$D > 1,200$

D - G = value of damage borne by applicant

Y = gross weekly income of the couple

Y_i = gross weekly income of ith employed child living at home

W = wealth (as defined for this purpose)

Z = number of employed children living at home

Source: Derived by authors.

Table B-6

FORMULAE FOR DETERMINING VALUE OF DAMAGE BORNE BY THE APPLICANT — SINGLE PERSONS WITH DEPENDANTS AND EMPLOYED CHILDREN LIVING AT HOME (SDeZ) — PERSONAL DISTRESS AND HARSHIP ASSISTANCE

Case 25	$Y + .25 \sum_{i=1}^Z Y_i \leq 100 + 8N$	$D - G = 0,$	$D \leq 400$
	$W \leq 1,000$	$D - G = D - 400,$	$D > 400$
Case 26	$100 + 8N < Y + .25 \sum_{i=1}^Z Y_i < 133.33 + 8N$	$D - G = .03[Y + .25 \sum_{i=1}^Z Y_i - (100 + 8N)] D,$	$D \leq 400$
	$W \leq 1,000$	$D - G = D - 400 + .03[Y + .25 \sum_{i=1}^Z Y_i - (100 + 8N)] 400,$	$D > 400$
Case 27	$Y + .25 \sum_{i=1}^Z Y_i \leq 100 + 8N$	$D - G = D,$	$D \leq (W - 1,000)$
	$1,000 < W < 1,400$	$D - G = (W - 1,000),$	$(W - 1,000) < D \leq 400$
		$D - G = D - 400 + (W - 1,000),$	$D > 400$
Case 28	$100 + 8N < Y + .25 \sum_{i=1}^Z Y_i < 133.33 + 8N$	$D - G = D,$	$D \leq \frac{(W - 1,000)}{Z}$
	$1,000 < W < 1,400$	$D - G = .03[Y + .25 \sum_{i=1}^Z Y_i - (100 + 8N)] D + (W - 1,000),$	$\frac{(4 - .03Y - .0075 \sum_{i=1}^Z Y_i + .24N)}{Z} < D \leq 400$
		$D - G = D - 400 + .03[Y + .25 \sum_{i=1}^Z Y_i - (100 + 8N)] 400 + (W - 1,000),$	$\frac{(W - 1,000)}{Z} < D \leq 400$

D - G = value of damage borne by applicant

Y = gross weekly income of parent

Y_i = gross weekly income of ith employed child living at home

W = wealth (as defined for this purpose)

N = number of dependants

Z = number of employed children living at home

FORMULAE FOR DETERMINING VALUE OF DAMAGE BORNE BY THE APPLICANT — MARRIED COUPLES WITH DEPENDANTS AND EMPLOYED CHILDREN LIVING AT HOME (MDeZ) — PERSONAL DISTRESS AND HARSHIP ASSISTANCE

<u>Case 29</u>	$Y + .25 \sum_{i=1}^Z Y_i \leq 140 + 8N$	$D - G = 0,$	$D \leq 1,200$
	$W \leq 1,000$	$D - G = D - 1,200,$	$D > 1,200$
<u>Case 30</u>	$140 + 8N < Y + .25 \sum_{i=1}^Z Y_i < 173.33 + 8N$	$D - G = .03[Y + .25 \sum_{i=1}^Z Y_i - (140 + 8N)]D,$	$D \leq 1,200$
	$W \leq 1,000$	$D - G = D - 1,200 + .03[Y + .25 \sum_{i=1}^Z Y_i - (140 + 8N)]1,200,$	$D > 1,200$
<u>Case 31</u>	$Y + .25 \sum_{i=1}^Z Y_i \leq 140 + 8N$	$D - G = D,$	$D \leq (W - 1,000)$
	$1,000 < W < 2,200$	$D - G = (W - 1,000),$	$(W - 1,000) < D \leq 1,200$
		$D - G = D - 1,200 + (W - 1,000),$	$D > 1,200$
<u>Case 32</u>	$140 + 8N < Y + .25 \sum_{i=1}^Z Y_i < 173.33 + 8N$	$D - G = D,$	$D \leq \frac{(W - 1,000)}{Z}$
	$1,000 < W < 2,200$	$D - G = .03[Y + .25 \sum_{i=1}^Z Y_i - (140 + 8N)]D + (W - 1,000),$	$(5.2 - .03Y - .0075 \sum_{i=1}^Z Y_i + .24N)$
		$\frac{(W - 1,000)}{(5.2 - .03Y - .0075 \sum_{i=1}^Z Y_i + .24N)} < D \leq 1,200$	
		$D - G = D - 1,200 + .03[Y + .25 \sum_{i=1}^Z Y_i - (140 + 8N)]1,200 + (W - 1,000),$	$D > 1,200$

D - G = value of damage borne by applicant

W = wealth (as defined for this purpose)

Y = gross weekly income of the couple

N = number of dependants

Y_i = gross weekly income of ith employed child living at home Z = number of employed child living at home

Source: Derived by authors.

Appendix C

DIAGRAMMATIC PRESENTATION OF VALUE OF DAMAGE BORNE BY THE APPLICANT AS A FUNCTION OF DAMAGE — SINGLE PERSONS WITH DEPENDANTS (CASES 9-12)

This appendix contains three charts which depict the value of damage borne by the applicant as a function of damage for single persons with dependants. These charts are drawn on the same scale as Charts V-8 to V-11 in the text. Each chart in this appendix has a set of dashed lines to facilitate comparisons of applicants in equal and unequal economic positions. In each chart, the following three features emphasised in the text are evident:

- (a) applicants with the same income and/or wealth may bear widely different values of damage themselves;
- (b) applicants with different levels of income and/or wealth may bear the same value of damage themselves; and
- (c) applicants with higher income and/or wealth than other flood victims may bear a lower value of damage themselves.

The following notations are used in this appendix:

- Case 9 — applicant's entitlement unaffected by either means test;
- Case 10 — applicant's entitlement affected by income means test only;
- Case 11 — applicant's entitlement affected by wealth means test only;
- Case 12 — applicant's entitlement affected by both means tests;

D - G = value of damage borne by applicant;

Y = gross weekly income of parent;

EY = excess income;

W = wealth (as defined for this purpose);

EW = excess wealth;

N = number of dependants.

Chart C-1

VALUE OF DAMAGE BORNE BY THE APPLICANT AS A FUNCTION OF DAMAGE — CASES 9 AND 10,
PERSONAL DISTRESS AND HARSHIP ASSISTANCE

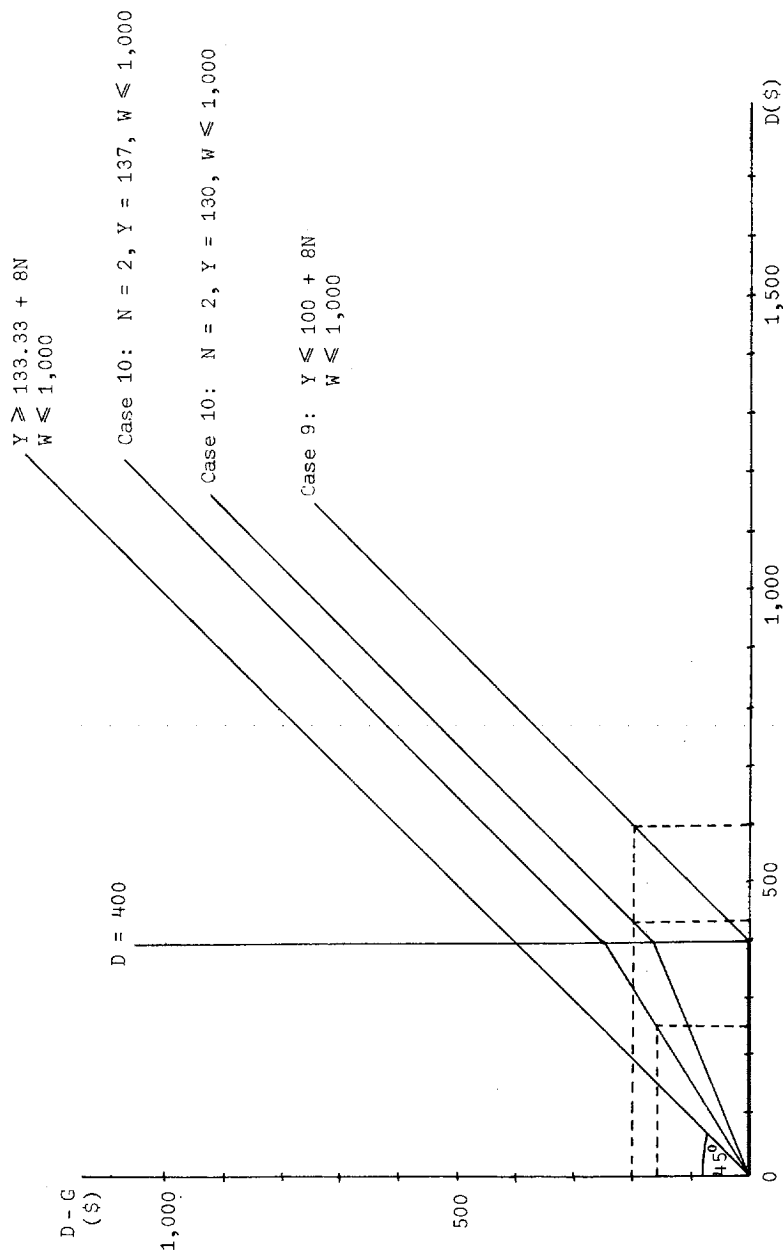


Chart C-2

VALUE OF DAMAGE BORNE BY THE APPLICANT AS A FUNCTION OF DAMAGE — CASES 9 AND 11,
PERSONAL DISTRESS AND HARDSHIP ASSISTANCE

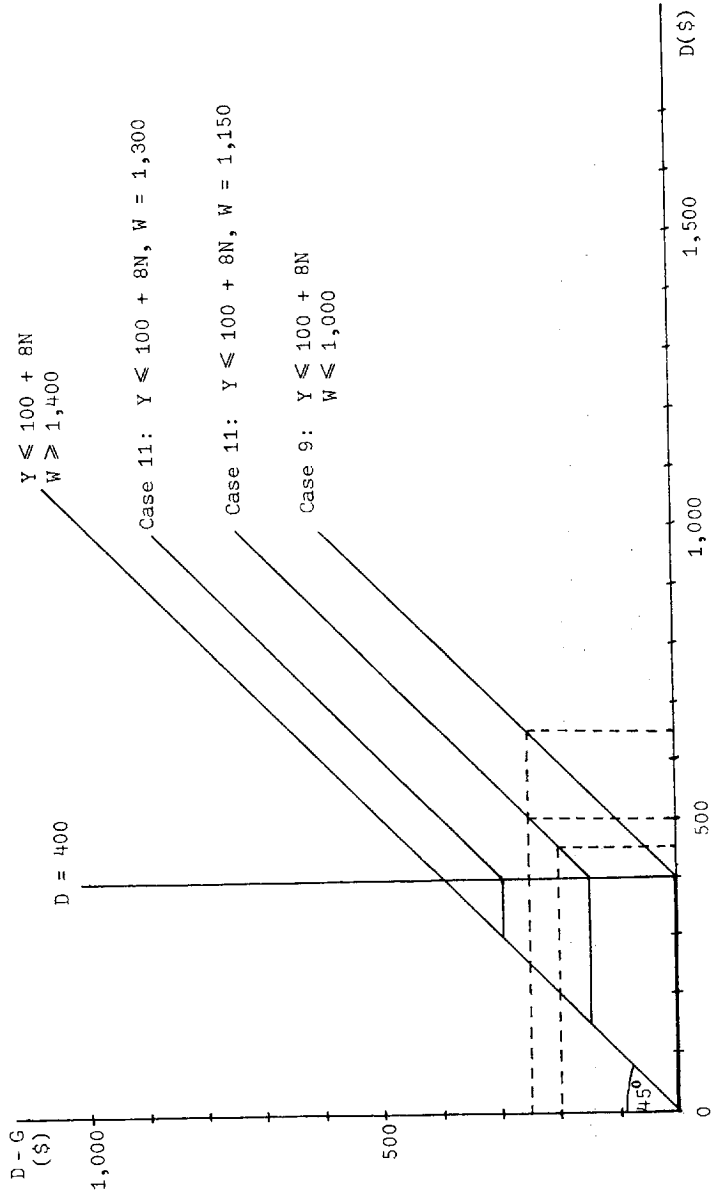
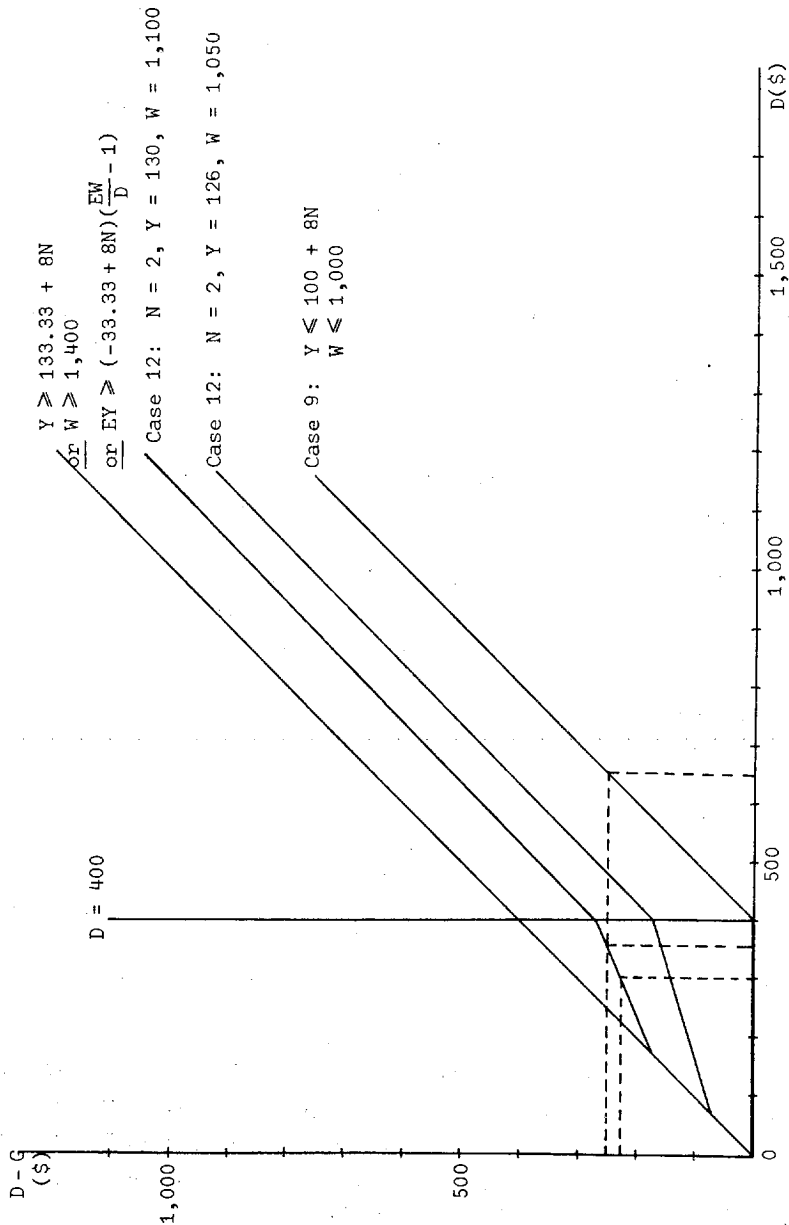


Chart C-3

VALUE OF DAMAGE BORNE BY THE APPLICANT AS A FUNCTION OF DAMAGE — CASES 9 AND 12,
PERSONAL DISTRESS AND HARDSHIP ASSISTANCE



Bibliography

- Allan, C. M. *The Theory of Taxation*, Penguin, Harmondsworth, 1971.
- Arrow, K. J. "The Economics of Moral Hazard: Further Comment", *American Economic Review*, Vol. 58, No. 5, June 1968.
- Arrow, K. J. "Uncertainty and the Welfare Economics of Medical Care", *American Economic Review*, Vol. 58, No. 5, December 1963, reprinted in M. H. Cooper and A. J. Culyer (eds), *Health Economics*, Penguin, Harmondsworth, 1973.
- Aitkin, A. P. "A Stage-Damage Curve for the Brisbane River", in *Hydrology Symposium 1976*, The Institution of Engineers, Australia, Sydney, 1976.
- Atkinson, A. B. *The Economics of Inequality*, Oxford University Press, 1975.
- Atkinson, A. B. *Unequal Shares: Wealth in Britain*, rev. edn, Penguin, Harmondsworth, 1974.
- Atkinson, A. B. (ed.) *Wealth, Income and Inequality: Selected Readings*, Penguin, Harmondsworth, 1973.
- Australian Association of Social Workers (Queensland Branch) *Social and Psychological Consequences of Natural Disaster: Proceedings of Symposium*, Brisbane, mimeo., 1974.
- Australian Bureau of Statistics *Australian Municipal Information System Manual*, 2nd edn, Australian Bureau of Statistics, Canberra, 1977.
- Australian Bureau of Statistics *Australian Municipal Information System Printout*, Data Edition No. 4, Australian Bureau of Statistics, Canberra, 1978.
- Australian Bureau of Statistics *Australian National Accounts: National Income and Expenditure 1974-75*, Australian Bureau of Statistics, Canberra, 1976.
- Australian Bureau of Statistics *Australian National Accounts 1976-77: Preliminary Statement No. 1*, Australian Bureau of Statistics, Canberra, 1978.
- Australian Bureau of Statistics *Consumer Price Index - June Quarter 1976*, Australian Bureau of Statistics, Canberra, 1976.
- Australian Bureau of Statistics *Consumer Price Index - June Quarter 1977*, Australian Bureau of Statistics, Canberra, 1977.
- Australian Bureau of Statistics *Consumer Price Index - March Quarter 1978*, Australian Bureau of Statistics, Canberra, 1978.
- Australian Bureau of Statistics *Population and Vital Statistics: June Quarter 1977*, Australian Bureau of Statistics, Canberra, 1978.
- Australian Bureau of Statistics *Public Authority Finance: State and Local Authorities 1975-76*, Australian Bureau of Statistics, Canberra, 1978.
- Australian Bureau of Statistics *Public Authority Finance: Taxation 1976-77*, Australian Bureau of Statistics, Canberra, 1978.
- Australian Bureau of Statistics *Summary of Vital and Population Statistics: September and December Quarters 1975*, Australian Bureau of Statistics, Canberra, 1976.
- Australia, House of Representatives *Debates*, 1967, Vol. H. of R. 55.
- Australia, House of Representatives *Debates*, 1974, Vol. H. of R. 88.
- Australia, House of Representatives *Debates*, 1975, Vol. H. of R. 93.
- Australia, Senate *Debates*, 1967, Vol. S. 34.
- Australia, Senate *Debates*, 1974, Vol. S. 59.
- Australian Treasury *A Natural Disaster Insurance Scheme for Australia: A Discussion Paper*, A.G.P.S., Canberra, 1976.
- Australian Treasury *Commonwealth Payments to or for the States 1968-69*, Commonwealth Government Printer, Canberra, 1968.
- Australian Treasury *Commonwealth Payments to or for the States 1971-72*, A.G.P.S., Canberra, 1971.

- Australian Treasury *Income Tax Statistics*, Government Printer of Australia, Canberra, 1973.
- Australian Treasury *Income Tax Statistics*, A.G.P.S., Canberra, 1974.
- Australian Treasury *Income Tax Statistics*, A.G.P.S., Canberra, 1975.
- Australian Treasury *Income Tax Statistics*, A.G.P.S., Canberra, 1976.
- Australian Treasury *Income Tax Statistics*, A.G.P.S., Canberra, 1977.
- Australian Treasury *Net Wealth Taxes*, A.G.P.S., Canberra, 1974.
- Australian Treasury *Payments to or for the States and Local Government Authorities 1974-75*, A.G.P.S., Canberra, 1974.
- Australian Treasury *Payments to or for the States and Local Government Authorities 1975-76*, A.G.P.S., Canberra, 1975.
- Australian Treasury *Payments to or for the States and Local Government Authorities 1976-77*, A.G.P.S., Canberra, 1976.
- Australian Treasury *Payments to or for the States and Local Government Authorities 1977-78*, A.G.P.S., Canberra, 1977.
- Barton, C. "Opening Address", in *January 1974 Floods Moreton Region: Proceedings of Symposium*, The Institution of Engineers, Australia, Queensland Division, Brisbane, 1974.
- Boughton, V. H. *A Survey of the Literature Concerning the Effects of Fire on the Forests of Australia*, Council of the Municipality of Ku-ring-gai, Gordon, 1970.
- Boulding, K. E. et al. (eds) *Transfers in an Urbanised Economy: Theories and Effects of the Grants Economy*, Wadsworth, Belmont, 1973.
- Buchanan, J. M. "Federalism and Fiscal Equity", *American Economic Review*, Vol. 40, No. 4, September 1950.
- Buchanan, J. M. *The Public Finances*, 3rd edn, Irwin, Homewood, 1970.
- Burkhead, J. and Miner J. *Public Expenditure*, Macmillan, New York, 1971.
- Cameron, J. G. "Flooding in Brisbane Metropolitan Creeks", *January 1974 Floods Moreton Region: Proceedings of Symposium*, The Institution of Engineers, Australia, Queensland Division, Brisbane, 1974.
- Chamberlain, E. R. et al., *Draft Queensland Flood Report: A Report to the Australian Department of Social Security*, mimeo., Brisbane, 1977.
- Cities Commission *Darwin Planning Guidelines 14 March 1975*, A.G.P.S., Canberra, 1975.
- Cities Commission *Planning Options for Future Darwin 28 January 1975*, A.G.P.S., Canberra, 1975.
- Cole, C. L. *Microeconomics: A Contemporary Approach*, Harcourt Brace Jovanovich, New York, 1973.
- Cooper, M. H. and Culyer, A. J. (eds) *Health Economics*, Penguin, Harmondsworth, 1973.
- Commonwealth Bureau of Census and Statistics *Population and Dwellings in Local Government Areas and Urban Centres*, Bulletin 6 Part 9, Commonwealth Bureau of Census and Statistics, Canberra, 1974.
- Commonwealth Grants Commission *Thirty-ninth Report (1972) and Special Report (1972)*, Government Printer, Melbourne, 1972.
- Commonwealth Grants Commission *Forty-third Report 1976 on Special Assistance for States*, A.G.P.S., Canberra, 1976.
- Commonwealth Grants Commission *Forty-fourth Report 1977 on Special Assistance for States*, A.G.P.S., Canberra, 1977.
- Cossins, G. "Flood Envelopes and Frequencies for the Brisbane River", in *Hydrology Symposium 1976*, The Institution of Engineers, Australia, Sydney, 1976.
- Cyclone Disaster Emergency Ordinance 1975 (Northern Territory)*.

- Cyclone Disaster (Moratorium) Ordinance 1975* (Northern Territory).
- Cyclone Disaster Relief Fund Ordinance 1975* (Northern Territory).
- Dacy, D. C. and Kunreuther, H. *The Economics of Natural Disasters*, The Free Press, New York, 1969.
- Darwin Cyclone Damage Compensation Act 1975* (Australia).
- Darwin Reconstruction Act 1975* (Australia).
- Darwin Reconstruction Commission *First Annual Report 1975*, Government Printer of Australia, Canberra, 1976.
- Department of Repatriation and Compensation *Darwin Damage Compensation: Report for Period 31 May to 30 June 1975*, Government Printer of Australia, Canberra, 1976.
- Department of Repatriation and Compensation *Establishment of the Australian Government Insurance Office*, A.G.P.S., Canberra, 1975.
- Department of Science *Brisbane Floods January 1974: Report by Director of Meteorology*, A.G.P.S., Canberra, 1974.
- Department of Social Security *Darwin Cyclone Damage Compensation Act: Report for the Year Ended 30 June 1976*, The Acting Commonwealth Government Printer, Canberra, 1977.
- Dixon, J. (ed.) *The Public Sector*, Penguin, Ringwood, 1972.
- Drane, N. T., Edwards, H. R. and Gates, R. C. "The Australian Survey of Consumer Expenditures and Finances, 1966-68", *mimeo.*, 1969.
- Edwards, H. R. and Gates, R. C. "Survey of Consumer Finances, Sydney 1963-65", *mimeo.*, 1966.
- Feldstein, M. S. "The Income Tax and Charitable Contributions: Part I — Aggregate and Distributional Effects", *National Tax Journal*, Vol. XXXIII, March 1975.
- Fire Damage Relief Act 1967* (Tasmania)
- Fire Damage Relief Act 1970* (Tasmania)
- Fire Damage Relief Act 1972* (Tasmania)
- Foster, T. *Bushfire: History, Prevention, Control*, Reed, Sydney, 1976.
- Friedman, M. *Monetary Correction: A Proposal For Escalator Clauses to Reduce the Cost of Ending Inflation*, The Institute of Economic Affairs, London, 1974.
- Gates, R. C. "The Effect of Taxation on Incentive", reprinted in J. Dixon (ed.), *The Public Sector*, Penguin, Ringwood, 1972.
- Gillespie, W. I. "Effect of Public Expenditures on the Distribution of Income", in R. A. Musgrave (ed.), *Essays in Fiscal Federalism*, The Brookings Institution, Washington D.C., 1965.
- Government Flood Damaged Homes Committee *Report, mimeo.*, Brisbane, 1975.
- Grants Commission *Fortieth Report 1973*, A.G.P.S., Canberra, 1973.
- Grants Commission *Forty-first Report 1974 on Special Assistance for States*, A.G.P.S., Canberra, 1974.
- Grants Commission *Forty-second Report 1975 on Special Assistance for States*, A.G.P.S., Canberra, 1975.
- Grigg, T. J. "An Evaluation of Brisbane Flood Mitigation Proposals", in *Hydrology Symposium 1977: The Hydrology of Northern Australia*, The Institution of Engineers, Australia, Canberra, 1977.
- Gunton, R. *Personal Wealth in Australia 1953-1969*, Unpublished Ph.D. thesis, University of Queensland, Brisbane 1975.
- Haas, J. E. *The Consequences of Large-Scale Evacuation Following Disaster: The Darwin Australia Cyclone Disaster of December 25, 1974*, Natural Hazard Research Working Paper 27, 1976.

- Harley, N. *The Wild Months of Darwin*, Noel Harley Publications, Melbourne, 1977.
- Harris, C. P. *The Economics of the Financial Sector*, 2nd edn, Cheshire, Melbourne, 1975.
- Heatherwick, G. "Flood Forecasting and Warnings", in *January 1974 Floods Moreton Region: Proceedings of Symposium*, The Institution of Engineers, Australia, Queensland Division, Brisbane, 1974.
- Hirshleifer, J. "War Damage Insurance", *Review of Economics and Statistics*, Vol. 35, No. 12, May 1953.
- Hirst, R. R. and Wallace, R. W. (eds), *The Australian Capital Market*, 2nd edn, Cheshire, Melbourne, 1974.
- Hochman, H. M. and Rodgers, J. D. "The Optimal Tax Treatment of Charitable Contributions", *National Tax Journal*, Vol. XXX, March 1977.
- Hochman, H. M. and Rodgers, J. D. "Utility Interdependence and Income Transfers through Charity", in K. E. Boulding *et al.* (eds), *Transfers in an Urbanised Economy: Theories and Effects of the Grants Economy*, Wadsworth, Belmont, 1973.
- Hochman, H. M. and Rodgers, J. D. "Pareto Optimal Redistribution", *American Economic Review*, Vol. 59, September 1969.
- Houghton, R. W. (ed.) *Public Finance*, Penguin, Harmondsworth, 1970.
- Hunter, J. S. H. "Vertical Intergovernmental Financial Imbalance: A Framework for Evaluation", *Finanzarchiv*, Vol. 32, No. 3, 1974.
- Income Tax Assessment Act 1973* (Australia).
- Irish, J. L. "Flood Insurance", *Proceedings of the Symposium on Flood Plain Management*, The Institution of Engineers, Australia, Queensland Division, Brisbane, 1976.
- Kakwani, N. C. and Podder, N. "Distribution of Wealth in Australia", Department of Econometrics, University of New South Wales, Sydney, *mimeo.*, 1973.
- Knibbs, G. H. *The Private Wealth of Australia and Its Growth*, Commonwealth Bureau of Census and Statistics, Melbourne, 1918.
- Kunreuther, H. "The Case for Comprehensive Disaster Insurance", *The Journal of Law and Economics*, Vol. XI, April 1968.
- Kunreuther, H. *Recovery from Natural Disaster*, American Enterprise Institute for Public Policy Research, Washington D.C., 1973.
- Lane, W. R. "Australian Federalism: Equity and Efficiency", Department of Economics, University of Queensland, Brisbane, *mimeo.*, 1968.
- Lane, W. R. "Direct Taxes in Relation to the Division of Fiscal Powers", in R. L. Mathews (ed.), *Intergovernmental Relations in Australia*, Angus and Robertson, Sydney, 1974.
- Lane, W. R. "Financial Relationships and Section 96", *Public Administration*, Vol. 34, No. 1, March 1975.
- Luke, R. H. and McArthur, A. G. *Bushfires in Australia*, A.G.P.S., Canberra, 1978.
- Lydall, H. F. and Lansing, J. B. "A Comparison of the Distribution of Personal Income and Wealth in the United States and Great Britain", in A. B. Atkinson (ed.), *Wealth, Income and Inequality: Selected Readings*, Penguin, Harmondsworth, 1973.
- Lydall, H. F. and Tipping, D. G. "The Distribution of Personal Wealth in Britain", in A. B. Atkinson (ed.), *Wealth, Income and Inequality: Selected Readings*, Penguin, Harmondsworth, 1973.
- Lynes, T. "French Pensions", Bell, London, 1967.
- Margolis, J. and Guitton, H. (eds) *Public Economics*, Macmillan, New York, 1971.
- Mathews, R. L. (ed.) *Intergovernmental Relations in Australia*, Angus and Robertson, Sydney, 1974.

- Mathews, R. L. "Mechanisms for Fiscal Equalisation in an Integrated European Community", in *Report of the Study Group on the Role of Public Finance in European Integration*, Vol. II, Brussels, April 1977.
- Mathews, R. L. and Jay, W. R. C. *Federal Finance: Intergovernmental Relations in Australia since Federation*, Nelson, Melbourne, 1972.
- McArthur, A. G. "The Tasmanian Bushfire of 7th February 1967 and Associated Fire Behaviour Characteristics", in "Second Conference Papers of Australian National Conference on Fire", *mimeo.*, 1968.
- Murray, R. F. *Economic Aspects of Pensions: A Summary Report*, National Bureau of Economic Research, New York, 1968.
- Musgrave, R. A. (ed.) *Essays in Fiscal Federalism*, The Brookings Institution, Washington D.C., 1965.
- Musgrave, R. A. "Provision for Social Goods", in Margolis, J. and Guitton, H. (eds), *Public Economics*, Macmillan, New York, 1971.
- Musgrave, R. A. "Theories of Fiscal Federalism", *Public Finance*, Vol. 24, No. 4, 1969.
- Musgrave, R. A. *The Theory of Public Finance*, McGraw-Hill, New York, 1959.
- Musgrave, R. A. and Musgrave, P. B. *Public Finance in Theory and Practice*, 1st edn, McGraw-Hill, New York, 1973.
- Musgrave, R. A. and Peacock, A. T. (eds) *Classics in the Theory of Public Finance*, Macmillan, London, 1958.
- Natural Disasters Organisation, *Report by the Director General on the Darwin Relief Operations 25 December 1974 – 3 January 1975*, Government Printer of Australia, Canberra, 1975.
- Newman, H. E. *An Introduction to Public Finance*, Wiley, New York, 1968.
- New South Wales Flood Relief Act 1974* (Australia).
- Oates, W. E. *Fiscal Federalism*, Harcourt Brace Jovanovich, New York, 1972.
- Ochs, J. *Public Finance*, Harper and Row, New York, 1974.
- Pauly, M. V. "Income Redistribution as a Local Public Good", *Journal of Public Economics*, Vol. 2, January 1973.
- Pauly, M. V. "The Economics of Moral Hazard: Comment", *American Economic Review*, Vol. 58, No. 3, June 1968.
- Pigou, A. C. *A Study in Public Finance*, 1st edn, Macmillan, London, 1929.
- Prime Minister's Press Statement No. 186 of 18 February 1974.
- Phelps, E. S. (ed.) *Altruism, Morality and Economic Theory*, Russell Sage Foundation, New York, 1975.
- Queensland Disaster Welfare Committee "Report from the Elmes Road Flood and Community Advisory Centre — Rocklea", Brisbane, *mimeo.*, 1974.
- Queensland Flood Relief Act 1974* (Australia).
- Queensland *Parliamentary Debates*, 1974, Vol. 264.
- Reserve Bank of Australia *The Nature and Role of Finance*, Occasional Paper No. 1, Reserve Bank of Australia, Sydney, 1968.
- Reserve Bank of Australia *Statistical Bulletin: Financial Flow Accounts Supplement*, Reserve Bank of Australia, Sydney, August 1969.
- Reserve Bank of Australia *Statistical Bulletin: Financial Flow Accounts Supplement*, Reserve Bank of Australia, Sydney, 1976.
- Reserve Bank of Australia *Statistical Bulletin*, Reserve Bank of Australia, September 1977.
- Revell, J. R. S. "Assets and Age", *Bulletin of the Oxford Institute of Economics and Statistics*, Vol. 24, August 1962.

- Revell, J. R. S. *The Wealth of the Nation*, Cambridge University Press, Cambridge, 1967.
- Robbins, L. "Interpersonal Comparisons of Utility: A Comment", *Economic Journal*, Vol. 48, No. 192, December 1938.
- Samuelson, P. A. "The Pure Theory of Public Expenditure", *Review of Economics and Statistics*, Vol. 36, 1954, reprinted in R. W. Houghton (ed.), *Public Finance*, Penguin, Harmondsworth, 1970.
- Samuelson, P. A. "Diagrammatic Exposition of a Theory of Public Expenditure", *Review of Economics and Statistics*, Vol. 37, 1955, reprinted in R. W. Houghton (ed.), *Public Finance*, Penguin, Harmondsworth, 1970.
- Schaefer, J. M. "Philanthropic Contributions: Their Equity and Efficiency", *Quarterly Review of Economics and Business*, Vol. 8, Summer 1968.
- Shields, A. J. "Synoptic Meteorology of Flood Period", in *January 1974 Floods Moreton Region: Proceedings of Symposium*, The Institution of Engineers, Australia, Queensland Division, Brisbane, 1974.
- Simons, H. C. *Personal Income Taxation*, University of Chicago Press, Chicago, 1938.
- Snowy Mountains Engineering Corporation *Brisbane River Flood Investigations: Final Report*, Cities Commission, Canberra, 1975.
- Sporting Bodies (Natural Disaster Relief) Act 1974* (Queensland).
- States Grants (Drought Reimbursement) Act 1968* (Australia).
- States Grants (Schools) Act 1973* (Australia).
- States Grants (Water Resources Measurement) Act 1973* (Australia).
- Stretton, A. *Combating Disasters - Australia's New Concept*, Pacific Defence Reporter, October 1974.
- Stretton, A. *The Furious Days: The Relief of Darwin*, William Collins, Sydney, 1977.
- Swannell, P. and Isaacs, L. T. "An Assessment of the Consequences of the 1974 Flood in the Jindalee Area", Jindalee Area Flood Relief Action Committee, Brisbane, *mimeo.*, 1974.
- Tasmania Fire Victim's Welfare Organization *Report of the Executive*, Hobart, *mimeo.*, 1967.
- Tasmanian Grant (Fire Relief) Act 1967* (Australia).
- Taxation Review Committee *Full Report*, A.G.P.S., Canberra, 1975.
- Thurow, L. C. "Net Worth Taxes", *National Tax Journal*, Vol. 25, No. 3, September 1972.
- Tiebout, C. "A Pure Theory of Local Expenditures", *Journal of Political Economy*, Vol. 64, October 1956.
- Tuberculosis Further Agreement Act of 1969* (Queensland).
- United Nations *A System of National Accounts*, Studies in Methods, Series F, No. 2, Rev. 3, Statistical Office, Department of Economic and Social Affairs, New York, 1968.
- Vickrey, W. "Private Philanthropy and Public Finance", in E. S. Phelps (ed.), *Altruism, Morality and Economic Theory*, Russell Sage Foundation, New York, 1975.
- Ward, J. K. G. "Hydrology of the Floods" in *January 1974 Floods Moreton Region: Proceedings of Symposium*, The Institution of Engineers, Australia, Queensland Division, Brisbane, 1974.
- Wettenhall, R. L. *Bushfire Disaster: An Australian Community in Crisis*, Angus and Robertson, Sydney, 1975.
- White, G. F. (ed.) *Natural Hazards: Local, Natural, Global*, Oxford University Press, New York, 1974.
- Wiltshire, K. W. (ed.) *Administrative Federalism: Selected Documents in Australian Intergovernmental Relations*, University of Queensland Press, Brisbane, 1977.
- Winfrey, J. C. *Public Finance*, Harper and Row, New York, 1973.

Centre for Research on Federal Financial Relations

Publications in Print – April 1979

Books

- R. L. Mathews and W. R. C. Jay, *Federal Finance: Intergovernmental Financial Relations in Australia Since Federation*, Nelson, Melbourne, 1972, pp. xiv + 370 (out of print).
- R. L. Mathews (ed.), *Intergovernmental Relations in Australia*, Angus and Robertson, Sydney, 1974, pp. xiii + 310 (out of print).
- B. S. Grewal, *Centre-State Financial Relations in India*, Punjabi University Press, Patiala, 1975, pp. xvi + 268.
- Russell Mathews (ed.), *Making Federalism Work: Towards a More Efficient, Equitable and Responsive Federal System*, Centre for Research on Federal Financial Relations, Distributed by ANU Press, Canberra, 1976, pp. xiv + 219 (\$10.00).
- Kenneth W. Wiltshire, *Administrative Federalism: Selected Documents in Australian Intergovernmental Relations*, University of Queensland Press, Brisbane, 1977, pp. xiii + 309 (\$9.95).
- J. S. H. Hunter, *Federalism and Fiscal Balance: A Comparative Study*, ANU Press, Canberra, 1977, pp. xii + 271 (\$18.50).
- R. L. Mathews (ed.), *State and Local Taxation*, ANU Press, Canberra, 1977, pp. xx + 389 (\$12.50).
- Russell Mathews (ed.), *Local Government in Transition: Responsibilities, Finances, Management*, Centre for Research on Federal Financial Relations, Distributed by ANU Press, Canberra, 1978, pp. xii + 147 (\$8.50).
- C. P. Harris and Kay E. Dixon, *Regional Planning in New South Wales and Victoria Since 1944 With Special Reference to the Albury-Wodonga Growth Centre*, Centre for Research on Federal Financial Relations, Distributed by ANU Press, Canberra, 1978, pp. xiv + 251 (\$10.00).
- C. P. Harris, *Local Government and Regionalism in Queensland 1859 to 1977*, Centre for Research on Federal Financial Relations, Distributed by ANU Press, Canberra, 1978, pp. x + 224 (\$10.00).
- Ursula K. Hicks, *Federalism Failure and Success: A Comparative Study*, Macmillan, London, 1978, pp. ix + 205 (£8.95).

Research Monographs

Distributed by ANU Press, Canberra

- No. 1 J. E. Richardson, *Patterns of Australian Federalism*, 1973, pp. x + 142 (\$4.00).
- No. 2 J. S. H. Hunter, *Revenue Sharing in the Federal Republic of Germany*, 1973, pp. xi + 116 (out of print).
- No. 3 B. S. Grewal, *Fiscal Federalism in India*, 1974, pp. xi + 116 (\$3.50).
- No. 4 R. L. Mathews (ed.), *Fiscal Equalisation in a Federal System*, 1974, pp. xiii + 142 (\$4.00).
- No. 5 R. L. Mathews and W. R. C. Jay, *Measures of Fiscal Effort and Fiscal Capacity in Relation to Australian State Road Finance*, 1974, pp. xii + 79 (\$4.00).
- No. 6 R. S. Gilbert, *The Future of the Australian Loan Council with An Annotation of the Financial Agreement 1927-1966*, 1974, pp. xi + 218 (\$6.50).
- No. 7 R. L. Mathews (ed.), *Fiscal Federalism: Retrospect and Prospect*, 1974, pp. xxiii + 228 (\$5.00).
- No. 8 R. L. Mathews (ed.), *Responsibility Sharing in a Federal System*, 1975, pp. xxiv + 214 (\$5.00).

- No. 9 C. P. Harris, *The Classification of Australian Local Authorities*, 1975, pp. xiii + 127 (\$4.00).
- No. 10 B. P. Herber, *Fiscal Federalism in the United States of America*, 1975, pp. xiii + 121 (\$5.00).
- No. 11 M. H. Sproule-Jones, *Public Choice and Federalism in Australia and Canada*, 1975, pp. x + 103 (\$5.00).
- No. 12 J. A. Maxwell, *Specific Purpose Grants in the United States: Recent Developments*, 1975, pp. xiv + 100 (\$5.00).
- No. 13 P. D. Groenewegen, *The Taxable Capacity of Local Government in New South Wales*, 1976, pp. xiv + 156 (\$6.00).
- No. 14 R. M. Burns et al., *Political and Administrative Federalism*, 1976, pp. x + 113 (\$6.00).
- No. 15 Cedric Pugh, *Intergovernmental Relations and the Development of Australian Housing Policies*, 1976, pp. xiii + 119 (\$6.00).
- No. 16 D. G. Davies, *International Comparisons of Tax Structures in Federal and Unitary Countries*, 1976, pp. xii + 79 (\$6.00).
- No. 17 Garth Stevenson, *Mineral Resources and Australian Federalism*, 1977, pp. xi + 90 (\$6.00).
- No. 18 Richard H. Leach, *Perceptions of Federalism by Australian and Canadian Public Servants: A Comparative Analysis*, 1976, pp. xiii + 116 (\$6.00).
- No. 19 J. Y. Henderson, *Public Sector Debt in Australia 1962-63 to 1972-73*, 1977, pp. xix + 147 (\$6.00).
- No. 20 Malcolm C. Brown, *The Financing of Personal Health Services in New Zealand, Canada and Australia*, 1977, pp. xvii + 148 (\$6.00).
- No. 21 Richard H. Leach, *The Governance of Metropolitan Areas in Australia with Lessons from Canadian and American Experience*, 1977, pp. xi + 198 (\$6.00).
- No. 22 R. M. Burns, *Intergovernmental Fiscal Transfers: Canadian and Australian Experiences*, 1977, pp. x + 138 (\$6.00).
- No. 23 A. R. Prest, *Intergovernmental Financial Relations in the United Kingdom*, 1978, pp. viii + 118 (\$6.00).
- No. 24 Malcolm Bains, *Management Reform in English Local Government*, 1978, pp. x + 62 (\$6.00).
- No. 25 P. Bernd Spahn (ed.), *Principles of Federal Policy Co-ordination in the Federal Republic of Germany: Basic Issues and Annotated Legislation*, 1978, pp. xiv + 185 (\$10.00).
- No. 26 S. Bieri, *Fiscal Federalism in Switzerland*, 1979, pp. xiii + 108 (\$8.00).
- No. 27 J. R. G. Butler and D. P. Doessel, *The Economics of Natural Disaster Relief in Australia*, 1979, pp. xv + 147 (\$10.00).

Journal

Special Issue of PUBLIUS, Vol. 7, No. 3, Summer 1977, *Federalism in Australia: Current Trends* (Russell Mathews, ed.).

Occasional Papers

Centre for Research on Federal Financial Relations, Canberra.

- No. 1 Leo A. Hielscher, *The Financial Assistance Grant*, 1976, pp. viii + 45.
- No. 2 G. F. Berkeley, *Financing Education in Queensland: The State-Commonwealth Mix*, 1976, pp. ix + 53.
- No. 3 M. A. Haskell, *Decentralization or Concentration of Power? The Paradox of Revenue Sharing*, 1976, pp. v + 36.

- No. 4 A. R. G. Prowse and E. A. Morey, *The Financial Agreement and the Future of the Loan Council*, 1976, pp. v+ 25.
- No. 5 B. S. Grewal, *Fiscal Equalisation, the Grants Commission and the Schools Commission*, 1976, pp. v+ 21.
- No. 6 K. W. Ryan and W. D. Hewitt, *The Australian Constitutional Convention*, 1977, pp. v+ 36.
- No. 7 R. D. Barnes and R. Else-Mitchell, *Aspects of the New Federalism Policy*, 1977, pp. v+ 27.
- No. 8 Anthony Scott, *Central Government Claims to Mineral Revenues*, 1978, pp. viii+ 50.

Reprint Series

- No. 1 Russell Mathews, 'The Future of Government Finance', *Public Administration* (Sydney), Vol. XXXII, No. 2, June 1973.
- No. 2 Russell Mathews, 'Patterns of Educational Finance', *Australian Economic Papers*, Vol. 12, No. 21, December 1973.
- No. 3 C. P. Harris, 'Social Planning and Regionalism in Australia', *Proceedings of the Royal Australian Planning Institute (Queensland Division) 1974 Country Seminar*, Cairns, July 1974.
- No. 4 J. S. H. Hunter, 'Vertical Intergovernmental Financial Imbalance: A Framework for Evaluation', *Finanzarchiv*, Vol. 32, No. 3, 1974.
- No. 5 Russell Mathews, 'Fiscal Equalization for Local Government', *The Economic Record*, Vol. 50, No. 131, September 1974.
- No. 6 C. P. Harris, 'Financing Local Government in Australia', *Proceedings of the Central Branch of the Institute of Municipal Administration (Queensland Division)*, Seminar on Local Government, Rockhampton, May 1975.
- No. 7 W. R. Lane, 'Financial Relationships and Section 96', *Public Administration*, Vol. XXXIV, No. 1, March 1975.
- No. 8 James A. Maxwell, 'Federal Grants in Canada, Australia and the United States', *Publius*, Vol. 4, No. 2, Spring 1974.
- No. 9 C. P. Harris, 'A method of allocating block grants under the Australian Assistance Plan to take account of interregional differences in social needs', *Regional Funding under the Australian Assistance Plan*, A Social Welfare Commission Discussion Paper, June 1975.
- No. 10 Russell Mathews, 'Fiscal Equalisation in Australia: The Methodology of the Grants Commission', *Finanzarchiv*, New Series, Vol. 34, No. 1 (1975).
- No. 11 R. Else-Mitchell, 'The Australian Grants Commission', *Journal of Constitutional and Parliamentary Studies*, Vol. VIII, No. 4, October-December 1974.
- No. 12 John Shannon, 'The U.S. Advisory Commission on Intergovernmental Relations: Some Personal Observations', *A.N.U. Seminar Paper*, 4 September 1975.
- No. 13 G. Sawer, 'The Whitlam Revolution in Australian Federalism — Promise, Possibilities and Performance', *Melbourne University Law Review*, Vol. 10, Number 3, 1976.
- No. 14 P. B. Spahn, 'Issues of Municipal Reform and the Future Role of Local Governments in West Germany', *A.N.U. Seminar Paper*, 26 May 1976.
- No. 15 P. B. Spahn, 'The Australian Tax Sharing Proposals in the Light of West German Experiences', *Centre for Research on Federal Financial Relations Seminar Papers*, Sydney and Brisbane, 30 July and 24 September 1976.
- No. 16 Kenneth Wiltshire, 'Regional Coordination in Queensland', *Australian Journal of Public Administration*, Vol. XXXV, No. 2, June 1976.

- No. 17 Russell Mathews, 'The Changing Pattern of Australian Federalism', *Proceedings of the Nigerian Institute of International Affairs International Conference on Federalism*, May 1976.
- No. 18 Wilfred Prest, 'Intergovernmental Fiscal Relations: Some Implications for Australia of Recent Developments in U.S.A. and Canada', *Australian Economic Papers*, Vol. 15, No. 27, December 1976.
- No. 19 Russell Mathews, 'Mechanisms for Fiscal Equalisation in an Integrated Community', *Report of the Study Group on the Role of Public Finance in European Integration*, Volume II, Brussels, April 1977, Chapter 13.
- No. 20 R. Else-Mitchell, 'The Rise and Demise of Coercive Federalism', *Australian Journal of Public Administration*, Vol. XXXVI, No. 2, June 1977.
- No. 21 Geoffrey Sawyer, 'Seventy Five Years of Australian Federalism', *Australian Journal of Public Administration*, Vol. XXXVI, No. 1, March 1977.
- No. 22 J. S. H. Hunter, 'Joint Tasks in the Federal Republic of Germany', *A.N.U. Seminar Paper*, 22 February 1978.
- No. 23 Russell Mathews, 'Philosophical, Political and Economic Conflicts in Australian Federalism', *Proceedings of the 29th Annual Conference of the Institute of Public Administration of Canada*, Victoria, B.C., 8 September 1977.
- No. 24 Russell Mathews, 'Issues in Australian Federalism', *Economic Papers*, No. 58, March 1978.
- No. 25 P. Bernd Spahn, 'The Financial Behaviour of State-Local Governments in Australia', *A.N.U. Seminar Paper*, 8 December 1976.
- No. 26 Russell Mathews, 'Federal Balance and Economic Stability', *The Economic Record*, Vol. 54, No. 146, August 1978.
- No. 27 Anthony Scott, 'An Economic Approach to the Federal Structure', in S. D. Berkowitz, ed., *Canada's Third Option*, Macmillan, Toronto, 1978.

Annual Reports

- 1973 Report*, Centre for Research on Federal Financial Relations, Canberra, 1974, pp. 1-12 (out of print).
- 1974 Report and Review of Fiscal Federalism in Australia*, Centre for Research on Federal Financial Relations, Canberra, 1975, pp. 1-47.
- 1975 Report and Review of Fiscal Federalism in Australia*, Centre for Research on Federal Financial Relations, Canberra, 1976, pp. 1-103.
- 1976 Report and Review of Fiscal Federalism in Australia*, Centre for Research on Federal Financial Relations, Canberra, 1977, pp. 1-118.
- 1977 Report on Activities*, Centre for Research on Federal Financial Relations, Canberra, 1978, pp. iii+ 27.
- Australian Federalism 1977*, Centre for Research on Federal Financial Relations, Distributed by ANU Press, Canberra, 1978, pp. vii+ 136 (\$5.00).
- 1978 Report on Activities*, Centre for Research on Federal Financial Relations, Canberra, 1979, pp. iii+ 31.

The economics of natural disaster relief in Australia

J.R.G. Butler and D.P. Doessel

This monograph analyses two specific issues relating to natural disaster relief. First, the assignment of responsibility for natural disaster relief in a federal system is discussed and applied in an Australian context to determine how natural disaster payments affect vertical and horizontal balance. Secondly, attention is focused on the payments to Queensland following the widespread flooding that occurred in 1973-74.

This second issue is concerned with evaluating the criteria that were attached as conditions of the specific purpose grant and were used to distribute natural disaster relief to individuals.

These criteria are evaluated by reference to the

twin notions of horizontal and vertical equity in the public finance literature on taxation. It is found that the criteria were inequitable in that persons in equal economic positions were treated unequally and that persons in unequal economic positions were treated equally. The monograph concludes with an outline of a scheme for natural disaster relief which incorporates the notions of horizontal and vertical equity.

Darrel Doessel is a graduate of the University of Queensland and has been a Lecturer in Economics in the Department of External Studies at that University since 1975. Jim Butler is also a graduate of the University of Queensland and is currently a Lecturer in Economics in the Department of Business Studies at the North Brisbane College of Advanced Education. The authors' interests lie in the fields of welfare economics, public finance and health economics.

Cover photographs courtesy of the
Commonwealth Bureau of Meteorology

Distributed by ANU Press
PO Box 4 Canberra ACT 2600 Australia

Designed by ANU Graphic Design

ISBN 0 7081 1073 8

ISSN 0313-5969

