Relationship between Income Distribution and the Cost of Environmental Management in Australia

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Abstract

In this paper sustainable income of Australia is estimated by incorporating environmental capital depreciation allowance. The natural resources of Australia are valued as capital asset and a depreciation allowance for its maintenance is estimated and incorporated into a Keynesian Model of Income Determination for estimating sustainable income. The aim is to analyze the possibilities of achieving both sustainability and full employment in the economy. To explore the linkages between environmental depreciation, income distribution and employment, Environmental Kuznets Curve, Gini Coefficient and Lorenz Curve are applied to this analysis. Policy options based on income distributional impact of environmental capital depreciation allowance are discussed in detail.

Key words:

Asia Pacific, Environmental Kuznets Curve, sustainable development, income distribution, environmental capital depreciation allowance, gini coefficient

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I. Introduction:

Australia is highly dependent on its natural resources; therefore it needs to develop a national accounting system whereby the concept of natural resource asset depletion is incorporated into its national income accounts. The present study suggests that if the national income accounting system of the economy is deficient in highlighting the gap in estimated income and sustainable income, then such a system needs to be improved (Ahmed and Mallick 1997).

In a previous analysis of the Australian economy (Mallick, Sinden, and Thampapillai 2000), showed that reconciliation between the goals of sustainability and employment may be achieved by a real wage reduction of approximately 8-10%. The analysis was structured within the framework of a simple Keynesian model of income determination and a Cobb-Douglas production function.

A subsequent attempt to replicate this analysis for the Indonesian economy (Mallick 2002) revealed the impossibility of a real wage reduction as a policy option owing to the prevalence of very low wage rates across substantial sections of the economy. Consequently, it was necessary to recognize and include the prevailing patterns of income distribution in reconciling the goals of sustainability and employment. In Mallick et al. (2000), the 8-10% wage reduction was estimated by recourse to a Cobb-Douglas production function for full employment. This wage reduction amounted to the same magnitude as the environmental capital depreciation allowance that had to be subtracted from net national product in the Keynesian Income Determination model in order to achieve sustainability. In Mallick (2002) the environmental capital depreciation allowance in the Indonesian economy was recouped by implementing a real wage reduction amongst the richest 20% of the population so that across the board wage levels did not fall below the poverty line. The main guiding criterion that was used in Mallick (2002) was the choice of an income percentile group that would have the most desirable impact in terms of reducing inequality. Specifically, it was shown that by collecting the environmental capital depreciation allowance from the richest 20% of the population in Indonesia had the most desirable impact on the Gini Coefficient.

Although Mallick et al. (2000) did not consider inequality issues in the context of the Australian economy, recent evidence on the growing trends of inequality suggests that such considerations are warranted. Hence the main objective of this paper is to illustrate a framework for reconciling the goals of sustainability, employment and income distribution.

The paper is organized as follows. The next section deals with a review of inequality in Australia. Section III describes the model used for application of the depreciation allowances and estimates the sustainable income. This section also illustrates, with the aid of time series data, the associations between the following variables: (i) real per capita income (Y/N), (ii) environmental capital depreciation (C_{EM}), and (iii) the Gini coefficient (G). The hypothesis is that income inequality first increases and then decreases in relation to economic growth. This means that an inverted U-shaped curve represents the relationship between income inequality and the level of economic development (Akita, Lukman, Yamada 1999). The main assumption here is that the Australian economy is following a typical Kuznets curve. The relationship between (Y/N) and (C_{EM}) enables the test of the presence of an "Environmental-Kuznets Curve" (E-K-C) in Australia. Grossman and Krueger (1995) initially demonstrated the E-K-C with cross-sectional global data. Should there be a violation of the E-K-C and a strong association between C_{EM} and the G, then there is a strong need for an income distributional analysis in Australia. Section IV of this paper deals with an analysis of income distribution to recoup the C_{EM}. The main question posed here is: which section of the Australian community should be subjected to a wage reduction in order to reconcile the goals of employment and sustainability while at the same time reducing inequality. The final section of the paper deals with policy options for Australia.

II. Review of the income inequality in Australia:

In Australia, and other OECD countries, poverty is defined in relative terms rather than absolute terms (where mere survival is a struggle due to serious lack of resources). Relative poverty is defined when people have insufficient income and other resources and therefore are unable to fully participate in the customary life of their society. Poverty in Australia as in other OECD countries is inseparable from inequalities of income distribution and accessibility of services like healthcare, education, employment and housing. In Australia the needs of those living in absolute poverty is addressed more readily compared to funding programs required to eradicate relative poverty (Howe & Pidwell, 2002).

The Institute of Applied Economic Research carried out a large-scale social inquiry on poverty issues in Melbourne during 1966-70. The Henderson Poverty Line (HPL) developed during this study was Professor Ronald Henderson's everlasting contribution to poverty and social research. In their recent research the Brotherhood of St Laurence asked for a serious examination of poverty measures in Australia since researchers using different poverty measures are all showing quite different results.

According to Harding and Szukalska (2000), the Henderson poverty line amounted to 52.2 percent of average wage in 1982. By 1995-96 it amounted to 59.5 percent of average wage. As a result of its current indexing methodology the Henderson poverty line produces a picture of an ever-rising tide of poverty. According to Harding and Szukalska (2000) if the indexing method is not changed, in fifteen years time, one-third of the Australian population would appear to be living in poverty as the Henderson poverty line could reach 70 percent of average income by that time.

Statistical data is open to varying interpretation and there is a need to look at a range of methods that supplement and support rather than contradict statistical analysis. For example Harding and Szukalska (2000) have used four different poverty lines one of which is Henderson poverty line. The other two (half-median poverty line and half-average poverty line) are based on the Henderson Equivalence Scale. The half-median poverty line is set at half of the equivalent family disposable income for all Australians. As there has been strong growth for top income groups, there are some concerns about the validity of using median income. The half-average poverty line is set at half of the average equivalent family disposable income of all Australians. This poverty line is about 15 percent lower than the Henderson poverty line. The fourth one used is the OECD poverty line, which uses the OECD equivalence scale rather than the Henderson equivalence scale. The OECD equivalence scale gives higher weighting to the needs of a second adult and children within a household unit compared to the Henderson equivalence scale. The OECD scale gives a weight of one to the first adult, 0.7 to the second adult and 0.5 for each child whereas the

Henderson equivalence scale gives a weight of one to the first adult, 0.56 to the second adult and 0.32 to each child.

With technological change and expansion in international trade the demand for high-skill labor has steadily been increasing since the 1970s and similarly there has been a relative drop in demand for low-skill labor (Borland, 1999). Improvement in skills and education has also reduced the gender wage gap during the 1980s (Kidd and Shannon, 2001). From 1976 to 1997 the proportion of male employees earning less than $600 per week declined whereas, for earnings of more than $1080 the proportion increased. For female employees on the other hand the proportion decreased for weekly earnings less than $480 and increased for earnings more than $800. The main cause for this increased inequality in weekly earnings was the higher growth rate in the top income level by comparison to the bottom of the income distribution. During the same time period increases in real weekly earnings at all points of the income distribution for female employees, was higher than that of male employees (Borland, 1999).

Inequality in market income distribution between households increased during the 1980s and 1990s. During the same time period increase in inequality in market income distribution was offset to some extent by a progressive tax and transfer system. During the period 1981-1994, the Gini coefficient for disposable income decreased by 3.9 percent while for market income the Gini coefficient increased to 5.7 percent during the same time period (Borland, 1999). This increase in inequality occurred for both wage and salary type income and business/trust income. Inequality in salary and wage income increased during the early 1990s whereas inequality in business and trust income occurred mainly during 1980s. Inequality or polarization in income increased with changes in the composition of the household unit. With an increase in the proportion of single parent family units, couples without children, and the decrease in families with children, the composition of the family unit changed.

Borland (1999) suggested that since disposable income gave a much clearer picture of the family’s purchasing power, it was a much better measure of the family’s welfare than the labor market earnings. Similarly, consumption rather than income is a more appropriate measure for analyzing economic inequality (Barrett et al., 2000). Their study period covered the years from 1975 to 1993 and they found that consumption inequality was considerably smaller than the income inequality and grew by less than income inequality during this time. Their study indicated that there was only a slight increase in consumption inequality between 1975 and 1984 while between 1984 and 1988, consumption inequality actually decreased. It increased again between 1984 and 1993 showing sensitivity to macroeconomic cycles. The employment rate was below 5 percent in 1975, above 8 percent in 1984, around 6 percent in 1988 and then rose above 10 percent by 1993. As a result of the low ebb of the business cycle the deterioration in income inequality was much more dramatic than the increase in consumption inequality. Their findings show that each of the income distribution segments experienced a gain in average real equivalent expenditure over the study period, with the top distribution experiencing greatest absolute percentage gain. Overall increase in average real equivalent consumption for all income sections shows that households at the bottom of the distribution were dis-saving. This resulted from the average income falling while the average consumption rose for the population in the bottom 25 percent of income distribution during the study period.

In the next section of this paper an empirical application of this framework explores the linkages between environmental depreciation and income distribution for the Australian economy. Here relationship between income distribution and sustainability in Australia is quantified and elaborated along with its implications for macroeconomic policies.

III. Sustainable Income Determination Framework:

The main objective of this paper is to show the linkages between sustainability and income distribution. These are examined by recourse to a production function where capital stocks are assumed to be constant in the short run. In this paper, environmentally sustainable income is estimated for Australia by including the environment within a Keynesian aggregate demand framework. This follows an application by Thampapillai and Uhlin (1996, 1997). Data requirement for this estimation is the value of the environment as input. The technique used here is the replacement cost method, based on a simple proxy approach, although various techniques have been used to value environmental resources (Commonwealth Department of Finance, 1995).

In the traditional system of national accounts, the distinction between Gross National Product (GNP) and Net National Product (NNP) results from the deduction of depreciation allowance for manufactured capital. Similarly, from the viewpoint of environmentally sustainable income, there is also need to subtract from NNP a deprecation allowance (C_{EM}) for natural capital (Lutz and Serafy 1989). That is,

$$Y_S = NNP - C_{EM} \qquad (1)$$

where Y_S is sustainable income and C_{EM} is the allowance for depreciation of environmental capital.

In a simple formulation where NNP is defined as ($\phi+\beta Y$), the standard Keynesian equilibrium that neglects sustainability is defined as:

$$Y = \phi/(1-\beta) \qquad (2)$$

where ϕ represents all the components of GNP excluding consumption but, including the autonomous component of consumption, β is marginal propensity to consume, and Y is the income measure of national output. In such a context, the variable component consumption (C) that is responsive to changes in income is simply defined as βY.

Economists have traditionally employed the Cobb-Douglas (C-D) function to explain aggregate production in terms of capital and labor. A C-D function that displays constant returns to scale has been justified by several authors, for example Dornbusch et al. (1995) and Branson and Litvack (1981). That is,

$$Y = \alpha K^{1-\lambda} L^{\lambda}, \qquad (3)$$

or

$$\log Y = \log\alpha + \log(1-\lambda)K + \log(\lambda)L, \qquad (4)$$

Where Y is NNP, α represents a country specific constant, L the labor force and K is capital stock. Following standard production theory, λ is the elasticity of substitution of labor for capital, and $1-\lambda$ is the elasticity of substitution of capital for labor.

To illustrate the C-D function for each year, data from national income accounts were used to estimate yearly values of λ. Given the properties of the C-D function, λ is also the share of national income accruing to labor and $(1-\lambda)$ is the share of national income accruing to capital (Dornbusch and Fischer, 1994). Hence λ is estimated for each year as follows:

$$\lambda = [\text{Sum of all wages in national income}] / [\text{national income (NNP)}] \quad (5)$$

The full employment level of income in the economy (Y_F) was estimated by substituting the size of the total labor force into equation (3), as follows:

$$Y_F = \alpha K^{1-\lambda} L_F^{\lambda} \quad (6)$$

The amount of labor force that would be employed at the sustainable income (Y^*_S) level was also estimated from equation (3) as:

$$L_S = [Y^*_S/\alpha K^{(1-\lambda)}]^{1/\lambda} \quad (7)$$

Table 1 illustrates the estimates of Y^*, Y^*_S and Y_F for each year, estimated by applying equations (1), (2) and (6). Coefficients ϕ, β and γ were directly estimated from the national accounts. For example, the description given above, [ϕ = I+G-X-M], [β = C/Y] and [$\gamma = (\ln C_{EM})/Y$], where, I, G, X and M are respectively investment, government expenditure, exports and imports.

Table 1. Gini Coefficient, Per Capita Income and Estimated Sustainable Income using Three Measures of Environmental Depletion

Year	Y^*	Energy Consumption Y^*_S	Air, Water & Solid Waste Pollution Y^*_S	Pollution + Ozone Depletion Y^*_S	Y_F	$(Y^* - Y^*_S)$	$(Y_F - Y^*)$	$(Y_F - Y^*_S)$	Gini Coefficient Gini-C	Per Capita Income Y^*/P
1980	224	212	211	203	232	11	9	20	0.36	15,219
1981	231	220	219	210	240	11	8	20	0.37	15,494
1982	235	223	223	213	246	12	11	23	0.38	15,475
1983	230	219	218	207	247	12	16	28	0.38	14,958
1984	245	233	232	221	260	12	15	27	0.37	15,725
1985	256	243	243	231	270	13	14	27	0.37	16,197
1986	265	252	252	240	279	13	14	27	0.38	16,542
1987	271	257	258	245	285	14	15	28	0.36	16,640
1988	285	271	271	258	298	14	13	27	0.34	17,211
1989	296	281	282	268	307	15	11	26	0.32	17,577
1990	301	286	288	274	315	16	14	29	0.34	17,666
1991	297	282	284	269	317	16	20	35	0.34	17,201
1992	299	283	286	270	321	16	22	38	0.33	17,104
1993	312	296	299	283	335	16	23	39	0.33	17,675
1994	329	312	316	300	350	17	21	37	0.35	18,434
1995	343	326	329	313	363	17	20	37	0.38	18,975
1996	358	340	344	328	377	18	20	37	0.41	19,533
1997	371	352	357	340	391	18	21	39	0.41	20,003
1998	388	370	374	357	409	19	21	39	0.42	20,732
1999	409	390	395	377	429	19	19	38	0.42	21,613
2000	427	407	413	394	445	20	18	38	0.42	22,284

(Y) Income in Billions (1990 Dollars)
$(^*_S)$ Sustainable

Source:
GNP: Australian National Accounts: National Income, Expenditure and Product, ABS 5204
NNP: Capital consumption: Australian National Accounts: Capital Stock, ABS 5221
Labor: ABS HA3000.6203 & HA3000.1301 Year Book Australia 1997
Energy Statistics-Yearbook, United Nations
Pollution and Ozone Depletion: Lawn P and Sanders R, (1997), A Sustainable Net Benefit Index for Australia, 1966-67 to 1994-95, Griffith University Working Papers in Economics, No. 16, June 1997.
Year Book Australia 2002

According to Grossman and Krueger (1995) studies presented in The World Bank Development Report 1992 provide evidence that the relationship between environmental degradation and income have an inverted U-shaped relationship, this is called "Environmental-Kuznets Curve" (E-K-C). Grossman and Krueger (1995) demonstrated this E-K-C with cross-sectional global data. In the present study the relationship between real per capita income (Y/N) and environmental capital depreciation (C_{EM}) enables the same test for the presence of an "Environmental-Kuznets Curve" (E-K-C) in Australia. With the aid of time series data, the associations between the following variables: (i) real per capita income (Y/N); (ii) environmental capital depreciation (C_{EM}); and (iii) the Gini coefficient (G) is measured.

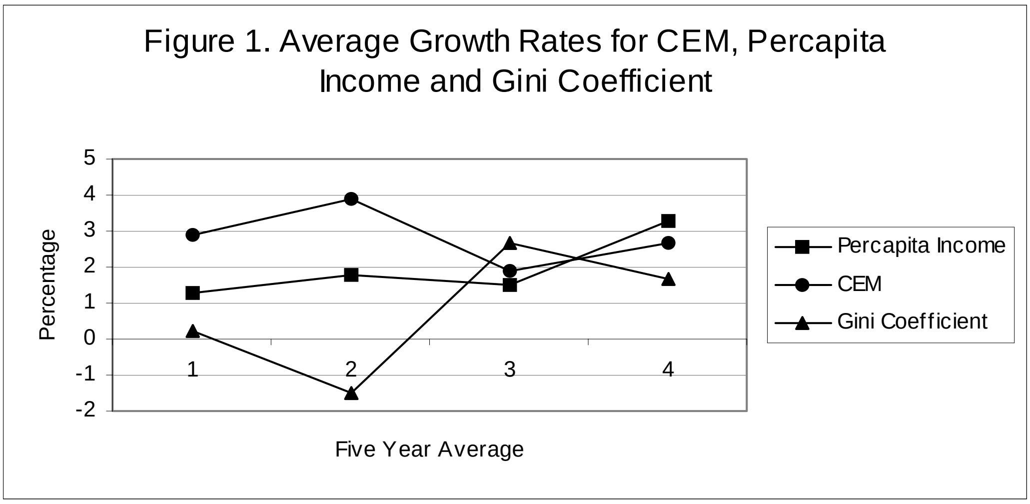
The relationship between real per capita income (Y/N) and environmental capital depreciation (C_{EM}) is presented here in quadratic form:

$$(Y/N) = (22905) + (-1492.7)(C_{EM}) + (73.9707)(C_{EM})^2$$

The relationship between environmental capital depreciation (C_{EM}); and the Gini coefficient (G) is presented here also in quadratic form:

$$(C_{EM}) = (273.597) + (-1438.3)(G) + (1985.49)(G)^2$$

Both these equations show that during the time period being studied all three variables experienced an increase. The growth rates were different for each of the three variables during different time periods. For example during 1989-90 C_{EM} had a high growth rate (Figure 1), whereas, growth in per capita income was quite slow. During 1998-2000 per capita income had a high growth rate, but the growth rate for C_{EM} had stabilized at a moderate level. This is mainly due to many initiatives by the State and Commonwealth Government to fund environmental management and energy efficiency programs. Since 1994-95 the Gini Coefficient has grown on an accelerated rate showing that income inequality is on the increase. By 1999-2000 the rate of increase had slowed down but the Gini Coefficient is at its highest level since 1980.



Thampapillai and Uhlin (1996; 1997) used total expenditure on energy consumption in an economy as a proxy for the environmental depreciation allowance. They justify this proxy on the premise that energy is a basic input in all production processes. At the same time, production and consumption of energy particularly from fossil fuels, results in pollution that could be related to depletion of the ozone layer, global warming and changes in weather patterns. Further, carbon is the main pollutant produced by the burning of fossil fuel. So far, there have been many attempts (Pearce 1993; Repetto et al., 1991, Tongeren et al., 1991), but no universally acceptable method to value depreciation of natural resources at the macro level and so a proxy must be used (Ahmed 2000).

One should note that the treatment here differs from that of Repetto et al. (1989) with reference to energy resources. Repetto et al. (1989) considered stocks of energy resources as wealth and hence defined the depletion value of energy resources by recourse to the concept of user costs. In the analysis reported here, the cost of domestic energy consumption is taken as a proxy for the depreciation of Australia's air shed and we refrain from dealing with the depletion of energy resources. Production of energy represents only a partial picture, as a certain portion is exported and is not consumed within the economy. Therefore, any environmental repercussions, which resulted from the exported portion of energy, would not appear in the national accounts of the country of origin.

The cost of pollution, particularly air pollution, represents the effects of unsustainable consumption activities. These effects have long-term repercussions like deterioration of human health, retardation of flora and fauna, damage to agricultural vegetation, materials damage and damage from acid rain (Lawn and Sanders 1997). Therefore, the value of pollution and ozone depletion can be used as proxies. For illustrative purposes, we confine the display of our analysis and discussion of policies to the use of the energy proxy.

IV. Analysis of income distribution:

Mallick, Sinden and Thampapillai (2000) applied the present methodology to achieve both full employment and sustainability. The major outcome was that to achieve both sustainability and full employment, overall consumption needed to be reduced. The remaining net balance went towards investment in natural resource management. In the present study, we focused on different income groups particularly the top 20% of the population to fund the process of adjustment through which both full employment and sustainability can be achieved. For more than a decade from the early 1980s to the early 1990s, the top 20% of the population in Australia owned 43% of the resources, but by the mid of the 1990s their ownership of the resources increased to 48%.

Within the confines of this simple conceptual framework, three policy options can be considered for reconciling sustainability and employment goals in Australia. These are:

- Obtain the allocation of funds for CEM from high-income earners;
- Distribute the burden of funding C_{EM} among all income groups according to the Lorenz curve for the economy;
- Population belonging to the lowest eight percent of the income distribution is exempted from covering the financial expenses for C_{EM}.

Income distribution methodology is used to determine who would be in a better position to absorb the burden of any additional amount needed to achieve both full employment and sustainability in Australia's economy. The paper suggests that the Commonwealth Government has two options here; one is to tax the population in top income bracket to increase its own income base and then increase spending in the concerned sector. The other is to create such investment incentives that the private sector invests in both sustainability and full employment. Table 2 presents the structure through which the top 20% of the population could contribute towards restoring the natural environment while at the same time creating additional employment in the economy.

Table 2. Income share of highest 20% before and after applying full employment and sustainability policy in Australia

						CEM-Energy			
			Before*				After*		
Year	GNP Australian Dollar		own % of GNP	own GNP Australian Dollar		give up Australian Dollar	give up % of GNP	own GNP Australian Dollar	own % of GNP
1980	224		43	97		25	11	72	32
1981	231		43	99		26	11	73	32
1982	235		44	104		27	12	76	33
1983	230		43	99		27	12	72	31
1984	245		43	105		30	12	76	31
1985	256		43	110		33	13	77	30
1986	265		45	120		34	13	86	32
1987	271		44	119		37	14	82	30
1988	285		42	120		40	14	80	28
1989	296		41	121		44	15	77	26
1990	301		42	127		47	16	79	26
1991	297		42	125		46	16	79	26
1992	299		42	126		48	16	78	26
1993	312		42	131		51	16	80	26
1994	329		44	145		55	17	90	27
1995	343		46	158		59	17	99	29
1996	358		48	173		63	18	110	31
1997	371		47	176		67	18	109	29
1998	388		48	188		72	19	115	30
1999	409		48	196		78	19	118	29
2000	427		48	205		84	20	121	28
			44				**15**		**29**

(Y) Income in Billions (1990 Dollars)

Source:
GNP: Australian National Accounts: National Income, Expenditure and Product, ABS 5204
NNP: Capital consumption: Australian National Accounts: Capital Stock, ABS 5221
Energy Statistics-Yearbook, United Nations
Year Book Australia 2002

The previous section has shown with the aid of time series data that an inverted U-shaped relationship exists between the following variables: (i) real per capita income (Y/N), (ii) environmental capital depreciation (C_{EM}), and (iii) the Gini coefficient (G). The relationship between (Y/N) and (C_{EM}) enabled the presence of an "Environmental-Kuznets Curve" (E-K-C) in Australia to be tested. Grossman and Krueger (1995) demonstrated that an inverted U-shaped relationship exists between per capita income and most pollutants. Only in the case of municipal waste per capita and carbon dioxide emissions, even with increase in per capita income the environmental condition continues to deteriorate.

Table 3. Investment in Natural Resources by Top 20, 30 and 40 percent of the Population and Resulting Redistribution of Income and Revised Gini Coefficient for 2000

	Gini Coefficient	Lowest 20%	Second 20%	Third 20%	Fourth 20%	Highest 20%
Actual	0.42	4	9	15	24	48

20%	Gini Coefficient	Lowest 20%	Second 20%	Third 20%	Fourth 20%	Highest 20%
Estimated	0.40	4	9	16	25	46

30%	Gini Coefficient	Lowest 20%	Second 20%	Third 20%	Fourth 20%	Highest 20%
Estimated	0.41	4	9	16	24	47

40%	Gini Coefficient	Lowest 20%	Second 20%	Third 20%	Fourth 20%	Highest 20%
Estimated	0.41	4	9	16	23	48

Source:
The World Bank, World Development Indicators (1998 - 2001)

The Lorenz curve and the Gini Coefficient are both indicators of the spread of income distribution in a country. In Australia's case in 2000, the Gini Coefficient was 0.42 yet with the top 40% of the population investing in natural resources the Gini Coefficient could change to 0.41. If the top 30% of the population provides for the C_{EM} amount, the Gini Coefficient would remain unchanged at 0.41. The Gini Coefficient could improve to 0.40 provided the total amount of C_{EM} for that year came from the top 20% income group. Table 3, shows that this Gini coefficient changes as the top 20% of the income group invest in natural resource management by fully funding the C_{EM} expenditure for that year. The top 20% would need to invest the amount of C_{EM} in the short term but in the long term the financial returns to investment in environment would compensate them for any short-term contraction of financial liquidity. This investment in natural resources could generate environmentally efficient production technologies and increase environment related employment in the economy. The investment then reduces unemployment and opens a whole new sector for innovative research and related training and education. Examples of these investments include cost effective methods of waste treatment, recycling, non-pollutive methods of energy production such as solar panels, bio-fuels, land and off-shore wind panels.

Table 4. Income and CEM share of all income groups in Australia
The CEM after the bottom eight percent of the income groups are exempted

Population group %	1990 % Income	Actual CEM	8% exmpt	1995 % Income	Actual CEM	8% exmpt	2000 % Income	Actual CEM	8% exmpt
5	1	0.13	0.00	1	0.13	0.00	1	0.13	0.00
10	3	0.32	0.09	3	0.35	0.10	2	0.32	0.09
15	4	0.30	0.32	4	0.32	0.34	3	0.30	0.32
20	6	0.29	0.31	5	0.31	0.33	4	0.30	0.32
25	9	0.29	0.31	8	0.32	0.34	6	0.31	0.33
30	12	0.30	0.32	10	0.33	0.35	8	0.34	0.36
35	14	0.33	0.35	13	0.36	0.38	11	0.38	0.40
40	17	0.37	0.39	15	0.40	0.42	13	0.44	0.46
45	21	0.41	0.43	19	0.46	0.48	17	0.51	0.53
50	26	0.48	0.50	23	0.52	0.54	20	0.59	0.61
55	30	0.55	0.57	26	0.60	0.62	24	0.69	0.71
60	34	0.63	0.65	30	0.70	0.71	28	0.81	0.83
65	40	0.73	0.75	36	0.80	0.82	34	0.94	0.96
70	46	0.84	0.86	42	0.92	0.94	40	1.08	1.10
75	52	0.96	0.98	48	1.05	1.07	46	1.24	1.26
80	58	1.09	1.11	54	1.19	1.21	52	1.42	1.44
85	69	1.23	1.25	66	1.35	1.37	64	1.61	1.63
90	79	1.39	1.40	77	1.52	1.54	76	1.81	1.83
95	90	1.55	1.57	89	1.70	1.72	88	2.03	2.05
100	100	1.73	1.75	100	1.90	1.92	100	4.77	4.79

CEM in Billions (1990 Dollars)
The World Bank, World Development Indicators (1998 - 2001)

Second and third policy options relate to funding of C_{EM} and how the burden of payment is distributed among different income groups according to their income distribution. The first policy option, where C_{EM} is funded by the top twenty percent of the population would result in a shift in income distribution in favor of the lower income groups. The second policy option suggests that all income groups fund C_{EM} according to their own percentage ownership of the resources. In this way the overall income distribution in the economy would remain the same. The third policy option exempts the bottom eight percent from contributing towards the C_{EM}. Table 4. Presents data for three years 1990, 1995 and 2000. As the lowest eight- percent of the population owns less than two percent of the resources, the burden distributed to the remaining ninety two percent of the population is minimal.

The three main aims here are:

- to measure the level of unemployment if environmental sustainability was the goal;
- to estimate the cost of achieving both sustainability and full employment and
- to determine which section of the economy should bear that cost.

To achieve sustainability in 2000 for example, 20 Billion Dollars needed to be set aside. To achieve full employment, another 18 Billion Dollars needed to be set aside (Table 1). Therefore, to achieve both full employment and sustainability, a total of 38 Billion Dollars was needed to be set aside.

V. Policy options:

The free market environmentalists present a premise that improvement in environmental quality depends on economic growth, which leads to higher incomes. The environmental Kuznets curve (EKC) follows the same principle (United Press International 2002). The EKC curve is based on the hypothesis about the income elasticity of demand for environmental quality. This implies that with continued income growth, there will be an increasing demand for products that are believed to be ‘green’ and environmentally safe. The stock of natural capital continues to decrease, while demand and consumption in an economy are increasing. The growing demand for environmental quality implies that people will increasingly value production processes that provide environmental or ecosystem services (Antle 1999).

Findings presented by Barrett et al. (2000) show that for the Australian economy during 1975 – 1993 income inequality has grown much more than consumption inequality. They found that consumption was much more equitable than income while income and consumption inequality grew over the same period. In fact these levels of inequality showed sensitivity to macroeconomic cycles. If sustainability needed to be enforced in its true sense, then the Commonwealth Government has to decide between two options. Either to pay for the gap in income due to the goals of sustainability and full employment and then pass on the burden to the economy. Or secondly, encourage the population to invest in natural resource management, and hence achieve both full employment and sustainability using incentive rather than taxation methods.

However, the concern about natural resource management in Australia is that there is a trade-off between natural resource management and employment for the Australian economy. If Australia follows a policy of sustainability it will be at a cost, namely the loss of employment in key industries such as, energy and transport. The Commonwealth acknowledged its obligation to reduce future greenhouse emissions but it also recognized the need to protect levels of employment and industrial growth. This paper shows that while this trade-off exists there are policy options available where both environmental sustainability and full employment are goals well within the reach of the Australian economy. This paper has presented a policy, which aims at providing for sustainability while having minimum impact on employment.

We have observed in the income distribution section of this paper that to achieve both sustainability and full employment there is a need to divert investment towards employment creation and maintenance as well as restoration of the natural environment. The policy options include focus on funding C_{EM} through various methods involving different income groups. One of the options is to involve the top twenty percent of the population that own about forty eight percent of the resources in Australia to contribute towards this financial allocation. The other option is to distribute the burden of funding C_{EM} to each income group according to appropriate allocation based on their income distribution. In this way no particular income group has extra weight to carry with regards to C_{EM}. Another option is to exempt the population belonging to the lowest eight percent of the income groups to contribute towards C_{EM}. Yet it remains at the government's discretion whether to directly involve each income group in contributing towards employment creation and maintenance of the natural environment.

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