# Guide to the Construction and Methodology of the Index of Economic Well-being[1]

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## Motivation and Foundations of the Index of Economic Well-being

The focus of this paper is an examination of how the Index of Economic Well-being (IEWB) developed by the Centre for the Study of Living Standards (CSLS) attempts to measure the economic component of societal well-being. Before turning in the second section to the practical aspects of data sources and construction of the Index, this first section discusses the motivation for the development of the IEWB and its theoretical underpinnings. The IEWB has been constructed for Canada and the provinces, the United States, and selected OECD countries, and the framework has also been applied to the development of an Index of Labour Market Well-being for Canada, the United States and OECD countries. See the CSLS website (www.csls.ca) for these papers and the underlying data.

A frequent refrain in the "social indicators" literature is the (true) statement that there is more to "well-being" than economics, but it is also recognized that a key component of overall well-being is economic well-being or "access to economic resources". Although there are good grounds for thinking that national income accounting measures may not necessarily be a good guide to popular perceptions of trends in economic well-being,[2] GDP per capita is probably the single most often mentioned criterion of economic progress. The development of the IEWB has been motivated by the question of whether it is possible to find a better measure of "access to economic resources".

An important point of difference with other indices is that the IEWB does not attempt to summarize "society's economic well-being" in a single, *objective* number. Rather, the IEWB is an attempt to provide each individual in society with a means of making a subjective evaluation of objective data in coming to a personal conclusion about society's well-being. Well-being has multiple dimensions and individuals differ (and have the moral right to differ) in their subjective valuation of the relative importance of each dimension of well-being. But because all adults are occasionally called upon, in a democracy, to exercise choices (e.g. in voting) on issues that affect the collectivity (and some individuals, such as civil servants, make such decisions on a daily basis), citizens have reason to ask questions of the form: "Would public policy X make 'society' better off?" Presumably, self-interest plays some role in all our choices, but unless self-interest is the sole criterion, an index of society's economic well-being is useful in helping individuals answer such questions.

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[1] This paper draws heavily on Osberg and Sharpe (2003).

[2] The paper (Osberg, 1985) that originated our research was motivated by Solow's observation that in 1980 Ronald Reagan asked the American people a seemingly simple question: "Are you better off today than you were four years ago?" Although U.S. real GDP per capita was, in 1980, some 8.8 per cent higher than in 1976, his audiences typically answered "No!"

The hypothesis underlying the IEWB is that indices of society's economic well-being can best help individuals to come to reasonable answers about social choices if information is presented in a way that highlights the objective trends in major dimensions of well-being and thereby helps individuals to come to summative judgments – but also respects differences in values. Although it may not be possible to define an *objective* index of society's economic well-being, individuals still have the problem (indeed, the moral responsibility) of coming to a *subjective* evaluation of social states, and they need organized, objective data if they are to do it in a reasonable way.

There is both a logic and a practical rationale to the identification of four components. The logic of the architecture is that it recognizes both trends in average outcomes and in the diversity of outcomes, both now and in the future, as Table 1 illustrates.

*Table 1 - Dimensions of Economic Well-being or Command over Resources*

| Concept | Present | Future |
|---|---|---|
| "Typical Citizen" or "Representative Agent" | Average Flow of Current Income | Aggregate Accumulation of Productive Stocks |
| Heterogeneity of Experiences of all Citizens | Distribution of Potential Consumption – Income Inequality and Poverty | Insecurity of Future Incomes |

When GDP per capita (or an alternative per capita income flow variable, such as the personal income or the GPI) is used as a summative index of well-being, the analyst implicitly is stopping in the first quadrant – assuming that the experience of a representative agent can summarize the well-being of society and that the measured income flow optimally weights consumption and savings, so that one need not explicitly distinguish between present consumption flows and the accumulation of asset stocks which will enable future consumption flows.

However, if society is composed of diverse individuals living in an uncertain world who typically "live in the present, anticipating the future", each individual's estimate of societal economic well-being will depend on the proportion of national income saved for the future. GDP is a measure of the aggregate market income of a society that does not reveal the savings rate, and there is little reason to believe that the national savings rate is automatically optimal. Indeed, if citizens have differing rates of time preference, any given savings rate will only be "optimal" from some persons' points of view. Hence, a better estimate of the well-being of society should allow analysts to distinguish between current consumption and the accumulation of productive assets, and thereby enable citizens to apply their differing values.

As well, individuals are justifiably concerned about the degree to which they and others will share in prosperity – there is a long tradition in economics that "social welfare" depends on

both average incomes and the degree of inequality and poverty in the distribution of incomes. If the future is uncertain, and complete insurance is unobtainable, individuals will also care about the degree to which their personal economic future is secure.

These four components therefore have a logical rationale and a manageable number of headings. If the objective of index construction is to assist public policy discussion, one must recognize that when too many categories have to be considered simultaneously, discussion can easily be overwhelmed by complexity. The IEWB therefore does not adopt the strategy of simply presenting a large battery of indicators.[3] However, because reasonable people may disagree in the relative weight they would assign to each dimension – e.g. some will argue that inequality in income distribution is highly important while others will argue the opposite – we argue that it is preferable to be explicit and open about the relative weights assigned to components of well-being, rather than leaving them implicit and hidden. An additional reason to distinguish the underlying components of economic well-being is that for policy purposes it is not particularly useful to know only that well-being has gone "up" or "down", without also knowing which aspect of well-being has improved or deteriorated. In the presentation of the IEWB *explicit* weights are specified for the components of well-being, and the sensitivity of aggregate trends to changes in those weights are tested, in order to enable others to assess whether, by their personal values of what is important in economic well-being, they would agree with an overall assessment of trends in the economy.

The basic underlying hypothesis – that a society's economic well-being depends on total consumption and accumulation, and on the individual inequality and insecurity that surround the distribution of macroeconomic aggregates – is consistent with a variety of theoretical perspectives. Therefore, a specific, formal model can be avoided.[4] The following section describes the details of the calculation of the four components or dimensions of economic well-being (see the appendix for diagrammatic and mathematical representations):

- [1] effective per capita consumption flows – which includes consumption of marketed goods and services, government services, and adjustment of effective per capita consumption flows for household production, changing household economies of scale, leisure and life expectancy.

- [2] net societal accumulation of stocks of productive resources – which includes net accumulation of tangible capital, housing stocks, net changes in the value of natural resources stocks, environmental costs, net change in the level of foreign indebtedness, accumulation of human capital and R&D investment.

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[3] The "dashboard" strategy of multiple indicators can be seen in operation at http://esl.jrc.it/dc/.

[4] However, a sufficient (but not necessary) set of conditions for the Index of Economic Well-being would be that societal economic well-being can be represented as the well-being of a "representative agent", if: (1) such an agent has a risk-averse utility function (i.e. diminishing marginal utility); (2) from behind a "veil of ignorance" as to his/her own characteristics, each person draws an individual income stream (and prospects of future income) from the actual distribution of income streams; (3) each person has a utility function in which both personal consumption and bequests to future generations are valued; (4) individual income streams are exposed to unpredictable future shocks; and (5) capital markets and public policies do not always automatically produce a socially optimal aggregate savings rate. A fuller discussion of the rationale for this framework of consumption, accumulation, distribution and insecurity can be found in Osberg (1985).

- [3] income distribution – the intensity of poverty (incidence and depth) and the inequality of income.

- [4] economic security from job loss and unemployment, illness, family breakup and poverty in old age.

Each dimension of economic well-being is itself an aggregation of many underlying trends, on which the existing data is of variable quality – and often differs across countries. By contrast, the System of National Accounts has had many years of development effort by international agencies (particularly the UN and the IMF), and has produced an accounting system for GDP that is rigorously standardized across countries. However, using GDP per capita as a measure of "command over resources" would implicitly:

(1) assume that the aggregate share of income devoted to accumulation (including the public capital stock, human capital, research and development and the value of unpriced environmental assets) is automatically optimal, and
(2) set the weight of income distribution and economic insecurity to zero, by ignoring entirely their influence.

Neither assumption seems justifiable, and neither is innocuous.

**Data Sources and Construction of the Index**

Average Consumption Flows

The easiest part of current consumption to measure is purchased consumer goods and services. Data on aggregate real personal consumption in constant prices are available from the national accounts, kept by virtually every country in the world. Population estimates, to calculate per capita personal consumption from the total consumption estimates from the national accounts, are also kept by most countries, as well as by the United Nations in the *Demographic Yearbooks*. When comparisons are to be made across countries though, the estimates in national currency units must be converted to a common currency. This conversion is accomplished using Purchasing Power Parity (PPP) estimates, which show the rate at which one country's currency must be exchanged with that of another country to equate the cost of an identical basket of goods in each country. Multilateral PPPs are provided by the OECD for a long time period, but note that only one PPP estimate for each country is necessary when converting series in constant national currency units, namely the PPP in the base year of the series. A more accurate measure of effective consumption flows, however, would include, in addition to measured consumption, adjustments for leisure, household size, regrettables, the underground economy, unpaid work, positional goods and life expectancy.

In some instances, assessment of aggregate trends in economic well-being may not be very sensitive to the omission of a particular variable, and the "underground economy" may provide an example. Since there always has been some level of "underground" activity, the issue for the measurement of trends in well-being is whether or not the prevalence of the underground economy has changed substantially over time. Some trends may encourage an expansion (e.g. rising tax rates), but other factors have worked in the opposite direction (e.g. the increased

penetration of franchise systems in the small business sector and the greater computerization of business records). However, whatever the direction of the trend, it is from a small base. Credible benchmark estimates of the prevalence of underground activity put it at a relatively small percentage of GDP. For example, Gervais (1994) estimated the upper limit of unmeasured production to be 2.7 per cent of GDP in Canada in the early 1990s. When the base level is small, the absolute size of a change is likely to be even smaller. Furthermore, comparable estimates of the underground economy are not available over time and across countries. Hence, this variable has been omitted from all recent work on the IEWB.

Also generally omitted are adjustments for that fraction of consumption expenditures that are arguably (like commuting expenses) an "intermediate input" in the production of income or a "defensive necessity" (like expenditure on anti-burglary measures due to higher crime rates) to offset the impact of adverse social trends. This class of expenditure has been labeled "regrettable expenditures" on the grounds that increases in such costs do not correspond to greater utility for consumers. In papers estimating the IEWB for Canada and the United States, estimates for regrettable expenditures were subtracted from personal consumption. However, such data are unavailable for other countries, and since there was little *trend* in the amount of such expenditures in North America, this omission may not be crucial.

Unpaid work, including both volunteer and household work, contributes to aggregate consumption possibilities and could therefore also be included in a measure of economic well-being. The problem here is again one of data availability. Statistics Canada (1996) has produced estimates of unpaid work for Canada and the provinces for the years 1961, 1971, 1981, 1986, and 1992, expressed in 1986 dollars. Therefore interpolation and extrapolation must be relied upon for all other years, and in general no data at all are available for other countries. There is also an issue of how unpaid work should be valued, for example in terms of opportunity cost before tax or after tax, or at the replacement cost using a specialist or generalist. The value of unpaid work is not surprisingly greatest when it is valued on the basis of opportunity cost before taxes, followed by replacement cost using a specialist, opportunity cost after tax, and finally replacement cost using a generalist. The rate of growth over time however, at least in the case of the Canadian data, is not greatly affected by which valuation method is used. Early work on the IEWB for Canada and the provinces added per capita unpaid work to per capita consumption expenditures, but this has not been possible for other countries.

One aspect that is perhaps important in measuring economic well-being but has never been considered by the IEWB due to data constraints is the case of positional goods. Positional goods can be defined as those goods in limited supply that provide utility only because they are inherently scarce. For example, only one type of motorcycle can be "the fastest in town", and if the point of the purchase of motorcycles is to be the fastest, increased competitive expenditures on horsepower generate no aggregate increase in utility. To the extent that individuals' overall satisfaction is related to the consumption of positional goods, increases in aggregate consumption will raise economic well-being by less than the increase in dollar value of consumption. This aspect of economic well-being has not been incorporated into the IEWB since it is unclear how to quantify the relative importance of positional goods and so their implications for economic well-being.

By contrast, good data are available on the significant increase in life expectancy in recent

years in developed countries, and there is every reason to believe that having a long life is an important component of economic well-being. Presumably people care both about how much they consume per year, and how many years they get to consume it. If one wants to measure the "command over resources" of people now alive, the economic value of consumption during these extra years of life should be included in the total consumption flows of individuals (Usher, 1980). Although a longer life span is valuable to people, GDP numbers will not reveal its importance, and may move in a contrary direction. If people can make more money by assuming more workplace risk, increases in marketed output that come from greater risk taking will have costs in decreased longevity that should be counted in an index of economic well-being. To obtain an estimate of the average impact on "command over resources" of decreased mortality, total effective per capita consumption flows in each year are adjusted upward by the percentage increase in average life expectancy relative to a base year.

To ensure comparability of consumption per capita estimates across countries given international differences in life expectancy, the estimates of life expectancy in a base country (typically the United States, as in the IEWB for OECD countries) are used as a benchmark and estimates for other countries adjusted by the ratio of that country's life expectancy to the base country estimate. Consumption is thus adjusted upward in countries with higher life expectancy than the United States and downward in countries with lower life expectancy. Implicitly this means that extra years of life are valued differently in different countries and at different times, because the current average level of consumption differs across countries and over time. This is appropriate in a measure of *economic* well-being or *command over resources,* but one must stress that economics is only part of a broader conception of well-being. It would be inappropriate (ethically and socially) in a summative index of overall "well-being" to imply that a life in a poor country is worth less than a life in a rich country. However, it is accurate to say that consumption (and economic well-being) during a lifetime is greater in a rich country. Data on life expectancy are typically available from the statistical agencies of most developed countries. For OECD countries data can be taken from the OECD Health Data CD-ROM.

The old saying "two can live as cheaply as one" is romantic, but it also exaggerates the fact that when individuals cohabit in households, they save money because they benefit from economies of scale in household consumption. However, households have shrunk in average size in most developed countries, implying the loss of some of the savings in cost of living that come from sharing a household. Trends in average per capita consumption should, therefore, be adjusted for the average loss in well-being over time due to lessened economies of scale in household consumption.

To ensure comparability of effective consumption per capita estimates across countries given international differences in average household size, household size in a base country (e.g. the United States) in a base year is used as the benchmark – i.e. the estimates of equivalent household size (the square root of household size) for other countries adjusted by the ratio of that country's equivalent household size to the base year U.S. estimate. Per capita consumption is thus adjusted upward in counties with a larger household size than the United States in the base year and downward in countries with a smaller household size. Data on average family size typically need to be calculated from individual country surveys, meaning that for many countries estimates are only available for a few years. In Canada the annual Survey of Consumer Finances (now the Survey of Labour and Income Dynamics) provides suitable data for such calculations, but for

other countries (and specifically when comparability across countries is important) one must rely on the Luxembourg Income Study (LIS). The LIS collects micro-data for most developed countries, but usually estimates are only available for four to five years in the past two decades.

A major defect of GDP as a measure of economic well-being is that because it counts only market income, it effectively assigns a zero value to leisure time. Across developed countries there are major differences in both the initial level and trends over time in the average annual number of hours worked. For example, in 1980 average working hours per adult (ages 15-64) were 1294.1 in the United States and 1161.2 in Germany. By 2001, working hours per adult had risen by 113 hours in the United States (to 1406.6) while falling by 119 hours in Germany (to 1042.2). These differences in working hours – the Germany/U.S. differential is equivalent to about 7.0 hours per adult per week – are now large enough to have a significant impact on a measure of economic well-being. Estimating hours of work in a comparable way across countries is a difficult task, but estimates are available from the OECD annual *Employment Outlook* publication and from the International Labour Organization's Key Indicators of the Labour Market annual publication (where the estimates above were taken from). Most countries collect hours data from either establishment-based or household-based surveys, but in general such data without adjustments are not comparable with data from other countries.

In order to value differences in working time, consumption is adjusted for differences in actual hours worked for persons of working age relative to a benchmark country (e.g. the United States) in a base year, with countries having average annual hours worked less than the benchmark having a positive adjustment to consumption and countries having more working time than the benchmark having a negative adjustment. This methodology amounts to saying that at the margin, individuals ascribe a value equal to the after-tax average wage (PPP-adjusted for cross-country comparisons) to changes in non-working time that are not due to unemployment fluctuations. However, unemployment does not constitute leisure. To account for involuntary leisure we subtract average annual hours of unemployment per working age person from the relative non-working time estimate (assuming that the unemployed would have wanted the average hours of work of the employed).[5]

In measuring the value of consumption, one should count the provision of non-marketed or heavily subsidized services by the government as part of the consumption flow. Current expenditure data for all levels of government including defense and capital consumption allowances, but excluding debt service charges and transfer payments, are also taken from the national accounting system of individual countries, expressed in constant prices and converted using PPPs to a common currency for comparisons of multiple countries. The importance of government final consumption expenditures relative to personal adjusted consumption expenditures differs markedly among OECD countries. In 2001, it ranged from a high of 33.3 per cent in Sweden to a low of 17.1 per cent in the United States, according to the national accounts kept by the OECD.

Total effective per capita consumption is defined as the sum of personal consumption per

[5]The psychological costs to unemployment imply that jobless time may have strong disutility (Clark and Oswald 1994). It is not possible, however, to provide estimates of the negative utility of unemployment time, nor the partial value of such time. Instead the IEWB assigns such hours zero value.

capita (adjusted for changes in average household size), government services, and the adjusted relative value of leisure (less regrettable expenditure and plus unpaid work where data are available), the total then being adjusted for changes in longevity of life (see the appendix for diagrammatic and mathematical representations).

Accumulation, Sustainability and the Intergenerational Bequest

If we think of "economic well-being" in the sense of "command over resources", then both present and future command over resources are relevant to current economic well-being. The economic well-being of the current generation depends on both their present and future lifetime levels of consumption. As well, if individuals alive today care about the well-being of future generations, measurement of trends in current well-being should include consideration of changes in the well-being of generations yet unborn. This consideration of future generations can also be justified on the grounds that a concept of "society" should include both present and future generations. Both the future consumption of the current generation and the well-being of future generations depend on the accumulation of real productive assets, broadly conceived to include natural and human resources as well as physical capital stock. These real stocks will determine whether a society is on a long-run sustainable trajectory of aggregate consumption, irrespective of the distribution among persons of claims on aggregate consumption flows at the individual level. If one is willing to assume that the aggregate savings rate, over all types of assets (public or private, priced or non-market) is always and everywhere optimal, then the division of current income between consumption and savings can be ignored (as is implicit in, for example, use of GDP per capita as a measure of "command over resources"). But this is an unreasonable assumption because (1) individuals may have different value judgments/preferences for their own future income and the income of future generations, which implies differing criteria of "optimality" and (2) given the empirical importance of assets that are not priced in the market (e.g. environmental assets), have substantial externalities (e.g. education or research and development) or are heavily influenced by public policy decisions (all assets), it is implausible to believe that optimality emerges automatically.

The physical capital stock includes residential and non-residential structures, machinery, and equipment in both the business and government sector – all of which enable future potential consumption flows, and economic well-being. Data for the current net fixed capital stock expressed in constant prices are generally collected by the statistical agencies of developed countries, but not necessarily in a form that is standard across countries. For Canada and the United States end-year net stock estimates are available based on infinite depreciation, although not necessarily at equivalent depreciation rates. For the most internationally comparable data possible, data can be taken from the OECD publication *Flows and Stocks of Fixed Capital*, although recent estimates are not available due to the comparability problem: the use of different depreciation rates and methods by statistical agencies may reduce comparability for both level and rate of growth comparisons.[6]

In a knowledge-based economy, the stock of skills embodied in the workforce is also a

[6] See Coulombe (2000) who notes that the average depreciation rate assumed for Canada's business sector capital stock over the 1961-97 period was 10 per cent compared to 4.4 per cent in the United States, which implies a substantially and artificially low relative estimate of the current capital stock.

crucial determinant of future economic well-being. There is a strong relationship between educational attainment and individual income and there is substantial evidence that education yields significant social benefits, over and above its impact on individual earnings. Although school retention and participation in post-secondary education have increased dramatically in many countries over the last three decades, human capital is intangible and is not now counted in balance sheet estimates of national wealth.

The IEWB estimates investment in human capital from the cost side, using the cost per year of education expenditures at the primary, secondary and post-secondary levels. Data on the educational attainment of the 25-64 population are typically available through household based surveys, i.e. the Labour Force Survey in Canada and the Current Population Survey in the United States, and are available for OECD countries from their annual *Education at a Glance*. Expenditure per student (available in both local currency and U.S. dollars from *Education at a Glance*) for the early childhood, primary, secondary, non-university tertiary and university level education are then multiplied by the number of people in each category and summed to estimate the aggregate stock of human capital, which is divided by total population to arrive at a per capita estimate. In order to distinguish clearly inter-country differences in the quantity of education obtained, as opposed to differences in its cost of production, the IEWB typically applies a common cost base (i.e. the cost of education in the United States) to all countries. Note that the interest here is in *economic* well-being, so that this calculation is not meant to capture the *social* value of education in increasing the human capability to lead a life of understanding and meaning, in which greater knowledge is in itself an aspect of a good life (see Anand and Sen, 2000).

In an era of rapid technological change, expenditure on R&D is also a crucial ingredient in the ability of society to innovate and create wealth. Statistical agencies do not produce R&D stock data, but data on annual flows of total business enterprise expenditure on research and development (collected by some national statistical agencies but also the OECD) can be accumulated into a stock of R&D capital valued at cost of investment. A depreciation rate on the declining balance must be chosen, and work on the IEWB has typically assumed a depreciation rate of 20 per cent. Also, since there is no "starting" stock it must be assumed that the stock starts from a base of zero in the year before the R&D investment series begins, so that the stock in the first year of the series is equal to investment in that year.

Current consumption levels could be increased by running down stocks of non-renewable natural resources or by exploiting renewable resources in a non-sustainable manner, but this would be at the cost of the consumption of future generations. A key aspect of the wealth accumulation component of economic well-being is net changes in the value of natural resources. From an intergenerational perspective, it is the value of the natural resources, not their physical extent, which counts. Internationally, data on trends are not available but the World Bank (1997) has produced estimates for one year (1994) of natural capital or "the entire environmental patrimony of a country" for nearly 100 countries – defined to include pastureland, cropland, timber resources, non-timber forest resources, protected areas, and sub-soil assets. On a per capita basis expressed in 1994 U.S. dollars, the values were: Canada ($36,590), Australia ($35,340), Norway ($30,220), United States ($16,500), Sweden ($14,590), United Kingdom ($4,940). Statistics Canada does collect data on the volume and value of many natural resources such as metals, subsoil minerals and forest resources for long time periods and by province, but this type

of data is generally unavailable for other countries.

In general, a financial instrument can be seen from two angles – it is an asset to the holder and a liability to the issuer. If both persons are residents of the same country, these assets and liabilities offset each other. We therefore do not count the gross level of government or corporate debt as a "burden" on future generations, and we do not count as part of the intergenerational bequest the value of paper gains in the stock market. Although the distribution of financial assets/liabilities will play a major role in *allocating* the future returns to the capital stock, the issue at this point is the *aggregate value* of the intergenerational bequest. However, since interest payments on the net foreign indebtedness of citizens of one country to residents of other countries will lower the aggregate future consumption options of home country citizens, increases in the level of net foreign indebtedness do reduce economic well-being within a given country. Estimates of the net investment position, expressed in current U.S. dollars, are published in the IMF's *International Financial Statistics Yearbook*. These estimates can be converted to current price national currencies at market exchange rates and then deflated by the GDP deflator and adjusted for population to obtain real per capita estimates in the net international investment position, expressed in national currency units. This type of data is also often available from statistical agencies. In the case of the IEWB for Canada and the provinces it would likewise be necessary to include net debt to other provinces, but unfortunately such data are not available.

As is the case with depletion of natural resources, current consumption can be increased at the expense of the degradation of the environment, reducing the economic well-being of future generations. Consequently, changes in the level of air and water pollution should be considered an important aspect of wealth accumulation. Probably the best-known environmental change is global warming arising from increased emissions of greenhouse gases, the most common of which is carbon dioxide emissions. Fortunately, data are available on these emissions and it is possible to estimate their costs. These costs can then be subtracted from the stock of wealth to obtain an environmentally adjusted stock of wealth.[7] Since global warming affects all countries, work on the IEWB has estimated world total costs of emissions and allocated these costs on the basis of a country's share of world GDP.

Fankhauser (1995) has estimated that the global social costs of CO2 emissions (with no adjustment for different national costs) at $20 U.S. per ton in 1990. According to data from the International Energy Agency, world CO2 emissions in 2000 were 23,444 millions of metric tons. Based on the $20 U.S. per ton cost of CO2 emissions, the world social cost of CO2 emissions was $468,880 million. This amount can be allocated on the basis on a country's share of nominal world GDP, available from the IMF, for example, or also from the Penn World Tables or Angus Maddison's *The World Economy: A Millennial Perspective*. As these costs represent a loss in the value of the services provided by the environment, they can be considered a deduction from the total stock of wealth of the society (worth, for example, -$339 in Canada in 2001).

As the estimates of the physical capital stock, the R&D capital stock, human capital, net

[7] The conceptual issues to be dealt with in estimating the costs of CO2 emissions include whether the costs should be viewed from a global, national or sub-national perspective, whether the costs increase linearly with the levels of pollution, whether the costs should be borne by the producer or receptor of trans-border emissions, and whether costs should vary from country to country or be assumed the same for all countries.

foreign debt, and environmental degradation are expressed in value terms in national currency units, they can be aggregated and presented on a per capita basis, and converted to a common currency using PPP estimates. Net foreign debt per capita is a negative entry, while the social costs of CO2 emissions are subtracted from the stocks of wealth.

Two further wealth variables that could contribute to future economic well-being but that have not been included in work on the IEWB due to data constraints and conceptual issues are consumer durables and social capital. Consumer durables are considered consumption goods but due to fairly long service lives can also be considered investment goods. However, little is known about how such goods depreciate over time (due, for example, to changing preferences for living room sets, or the discarding of washing machines long before the end of their service lives in favour of purchasing newer and more time efficient models). Since this raises questions about the role of the stock of consumer durables in increasing future economic well-being, and since such estimates are not necessarily available on a comparable basis for many countries, the IEWB does not include the per capita stock of consumer durables in its conception of total stocks of wealth. Social capital can be taken to include the social institutions that produce habits of honesty and cooperation, a justifiable sense of mutual trust in business dealings and a willingness to compromise in negotiations, all of which clearly help to make economic transactions run more smoothly. Therefore a larger stock of social capital in the present improves society's economic well-being in the future by allowing future economic interactions to take place more easily. However, despite work on "The World Values Survey" and the OECD's *Society at a Glance: OECD Social Indicators*, published annually since 2001, data on social capital remains sparse. Therefore the IEWB has so far not included social capital in its conception of total stocks of wealth.

Income Distribution – Inequality and Poverty

Would economic well-being remain the same if a society in which everyone has $500 income became one in which half the population had $999 and the other half had $1? Average income would remain unchanged, but the more equal society is likely to generate more aggregate utility.[8] The idea that the "Social Welfare" generated by a given aggregate "command over resources" depends, in general, on *both* average income and the inequality of incomes has a long tradition in welfare economics. However, in measuring the level of social welfare, the exact relative weight to be assigned to changes in average incomes, compared to changes in inequality, cannot be specified by economic theory.

As well, poverty is not quite the same issue as inequality. Since the economic well-being of the population is affected both by inequality in the distribution of income among all people and by the adequacy of incomes for the least well-off (i.e. the extent of poverty), there are two issues: 1) one's perspective on the importance of inequality/poverty compared to trends in average income, and 2) one's view of the relative weight to be placed on poverty compared to inequality. The IEWB, therefore, uses a compound sub-index to recognize explicitly that individuals would place some weight ($\beta$) on a measure of inequality in the aggregate distribution of income and some weight ($1-\beta$) on a measure of poverty.

[8] Because an additional dollar of income means less to a millionaire than to a pauper, economists tend to agree that "diminishing marginal utility" is a reasonable assumption.

The most popular measure of inequality in the distribution of income is undoubtedly the Gini index of after-tax, after transfer household income. The Sen-Shorrocks-Thon measure of poverty intensity is both theoretically attractive as a measure of poverty, and also convenient, since it can be decomposed as the product of the poverty rate, the average poverty gap ratio and the inequality of poverty gap ratios. Furthermore, since the inequality of poverty gap ratios is essentially constant, changes in poverty intensity depend on changes in the poverty rate and the average poverty gap ratio.[9]

The poverty rate can be defined in a number of ways, for example based on a relative concept as opposed to an absolute concept, based on after-tax/transfer income as opposed to before-tax/transfer income, or using households as opposed to families or individuals as the unit of measurement. As well the Gini coefficient can be based on different units of measurement and income concepts. Work on the IEWB has used the household as the unit of measurement and the after-tax/transfer concept of equivalent income for both variables. For poverty intensity, the poverty line has typically been defined as one half of median household equivalent income, a purely relative concept. These variables are calculated from micro data sets, such as the SLID in Canada and the LIS for OECD countries.

The overall index of distribution is a weighted average of the indices of poverty intensity for all units or households and the Gini coefficient. Typically both variables receive equal weight in the calculation of the IEWB for presentation purposes, but it is important to note that individuals will differ not only in the weight that they place on income distribution relative to the other components of economic well-being, but also on the weight that poverty intensity receive relative to inequality within the income distribution component. Unfortunately, the LIS database allows calculation of a long time series of income distribution estimates for only a few countries. Hence, in the case of the IEWB for OECD countries, values of the income distribution and poverty variables in the years before the first LIS estimate for each country are assumed equal to the estimate for the first year of LIS data and the values for the years after the last LIS estimate are assumed equal to the estimate of the last year of LIS data, with linear interpolation employed for years between LIS estimates.

Note that the inequality and poverty variables discussed here refer to the total population, hence imposing anonymity. For example, the poverty line is the same for each individual regardless of race, gender etc. In some early work on the IEWB an additional variable was considered for inclusion in the income distribution component, namely the trend in the male-female earnings differential. However, the key motivation of the IEWB is that income/earnings by itself is a poor measure of "command over resources" so that someone interested in male-female inequality should ideally compare the IEWB for men with the IEWB for women rather than simply earnings in each group. In principle the IEWB can be constructed for different age, gender and other groups, although due to the data effort required only the aggregate population has been considered in past work on the IEWB.

[9] See Osberg and Xu (2000).

Insecurity

If individuals knew their own economic futures with certainty, their welfare would depend only on their actual incomes over their lifetimes, since there would be no reason to feel anxiety about the future. However, if the human situation is one of "living in the present, anticipating the future", then uncertainty about what the future holds will decrease the current economic well-being of risk averse individuals. Although people try to avoid risk through social and private insurance, such mechanisms do not completely eliminate economic anxieties, which have to be considered a subtraction from well-being.

Although public opinion polling can reveal that many feel themselves to be economically insecure, and that such insecurity decreases their subjective state of well-being, there is no generally agreed definition of economic insecurity. Osberg (1998) has argued that economic insecurity is, in a general sense, "the anxiety produced by a lack of economic safety – i.e. by an inability to obtain protection against subjectively significant potential economic losses." Ideally, one would measure trends in economic security with data that included (for example) the percentage of the population who have credible guarantees of employment continuity and adequate personal savings to support consumption during illness or unemployment. However, such data are not widely available.

For these reasons, rather than attempt an overall measure of subjective economic insecurity, this paper adopts a "named risks" approach, and addresses the change over time in four key objective economic risks. Over fifty years ago, the United Nations' Universal Declaration of Human Rights stated:

> *Everyone has the right to a standard of living adequate for the health and well-being of himself and of his family, including food, clothing, housing and medical care and necessary social services, and the right to security in the event of unemployment, sickness, disability, widowhood, old age or other loss of livelihood in circumstances beyond his control*. [Article 25][10]

The IEWB insecurity component includes measures of the percentage change over time in the economic risks associated with unemployment, illness, "widowhood" (interpreted here as single female parenthood) and old age. In each case, the risk of an economic loss associated with the event is modeled as a conditional probability, which itself is the product of a number of underlying probabilities. The prevalence of economic risks is weighted by the proportion of the population that it affects. The core hypothesis underlying this proposed measure of economic insecurity is that changes in the subjective level of anxiety about a lack of economic safety are proportionate to changes in objective risk.

The economic risk associated with unemployment can be modeled as the product of the risk of unemployment and the extent to which people are protected from the income losses of unemployment. Changes in the employment rate (employment/population ratio) are taken as a

[10]Today, the gender specificity of the language of 1948 will strike many people as odd – but Article 2 makes it clear that all rights are to be guaranteed to male and female persons equally.

proxy for freedom from the risk of unemployment since changes in this ratio reflect both changes in the (negative of the) unemployment rate and changes in the participation rate (both cyclical and structural). The extent to which people have been protected by unemployment insurance (UI) from the financial impacts of unemployment can be modeled as the product of: 1) the percentage of the unemployed who claim regular UI benefits, and 2) the percentage of average weekly wages replaced by UI. For Canada and the United States such data are available from statistical agencies, based on administrative records of the programs. However, internationally comparable data on these two variables, particularly the first, have proven very difficult to obtain. Hence, an unpublished OECD series on the gross replacement rate for the unemployed must be used alternatively in the calculation of the risk of unemployment for OECD countries. This series shows a markedly different trend than the EI coverage rate for certain countries such as Canada in the 1990s.

The IEWB does not attempt to model the psychological insecurities associated with health or confront the issue of whether more education and greater knowledge of potential health risks (even risks of very small probability – such as "Mad Cow disease") produce greater or less anxiety. Again, the focus is on "command over resources" – the economic losses associated with illness. However, data limitations mean that trends in the risk of loss of earnings must be ignored.[11] Instead, the focus is on the risk of health care costs, assuming that risk is proportional to the share of uninsured private medical care expenses in disposable income. In Canada such data are available from the Canadian Institute for Health Information, and are available from the National Income and Product Accounts in the United States. The OECD Health Data CD-ROM, published annually, provides a long time series on medical care expenses per capita (excluding medical insurance premiums and net of insurance reimbursement for medical expenses) for OECD countries.

When the UN Universal Declaration of Human Rights was drafted in 1948, the percentage of single parent families was relatively high in many countries, partly as a result of World War II. At that point in time, "widowhood" was the primary way in which women and children lost access to male earnings. Since then, divorce and separation have become the primary origins of single parent families. However, it remains true that many women and children are "one man away from poverty", since the prevalence of poverty among single parent families is extremely high. To model trends in this aspect of economic insecurity, this sub-component of the IEWB is calculated as (the probability of divorce) * (the poverty rate among single female parent families)[12] * (the average poverty gap ratio among single female parent families).[13] The product of these last two variables is proportional to the intensity of poverty.

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[11] Historically, a portion of the labour force has had some income loss protection through sick leave provisions in their individual or collective employment contracts. One implication of a trend to short-term contract employment and self-employment in developed economies is an increase in the fraction of the population whose employment income ceases totally in the event of ill health.

[12] However, RATE= INCIDENCE x AVERAGE DURATION. Since the poverty rate among single parents is equal to the conditional probability that a single parent will enter poverty and the average duration of a poverty spell, this calculation implicitly accounts jointly for the duration of poverty spells and for their likelihood. Inadequacy of data precludes examination of household dissolution among co-habiting couples.

[13] This procedure effectively ignores single male parents, which can be justified on the grounds that males comprise a fairly small fraction of the single parent population in most developed countries, and their income loss on divorce is considerably less than that of women.

We stress that in constructing a measure of the economic insecurity associated with single parent status, we are *not* constructing a measure of the social costs of divorce. Economic well-being is only part of social well-being, and divorce has emotional and social costs (e.g. for the involved children) that are not considered here. As well, this approach does not model the economic risks to children associated with trends in out of wedlock births. Arguably, over time the social costs associated with these trends (e.g. stigma) have changed, as the institution of marriage itself has changed – but such issues lie well beyond the scope of this paper.

The necessary data for construction of the insecurity from the risk of single parent poverty sub-component of the overall security component of the IEWB are calculated from micro data sets. Internationally, data on divorce rates are drawn from the UN *Demographic Yearbook* and estimates of the poverty rate and poverty gap ratio for single female parents calculated from the LIS micro data tapes.

Since income in old age is the result of a lifelong series of events and decisions, the idea of "insecurity in old age" is modeled in a simplified way in the IEWB, namely as the chance that an elderly person will be poor multiplied by the average depth of that poverty. As with the other poverty and inequality variables looked at so far, it is necessary to calculate the elderly poverty rate and gap from micro data files.

Two further insecurity variables have been considered for inclusion in the IEWB in the past but have not been included in any calculations of the IEWB for conceptual or data reasons. These variables are unanticipated inflation and personal security measures. Anticipated inflation does not create "insecurity" since inflationary expectations become embedded in interest rates, which are known to both borrower and lender. Unanticipated inflation, however, causes unanticipated changes in the real value of money assets and liabilities and an unanticipated redistribution of real income. Since individuals worry about the possibility of such losses and gains, unanticipated inflation can also contribute to economic insecurity. This variable is not included in the IEWB because the goal of price stability adopted by many central banks in developed countries has meant that inflation in recent years fluctuates within too narrow a band to influence economic insecurity substantially, and also since accurate data on expected inflation is difficult to obtain. Freedom from economic catastrophe constitutes an element of economic security. Such catastrophes include crime, auto accidents and work accidents, which can cripple the ability of those affected to earn a living. The incidence of crime reported to police in Canada has increased significantly in recent years, but in contrast the probability of being killed in an auto accident or on the job has fallen. At this point, estimates of the incidence of crime and probability of being killed or injured in an auto accident have not been incorporated into the IEWB. It should be noted, however, that since 1999 the Canadian Council for Social Development has published a personal security index, which may be useful as a sub-component of the economic security component of the IEWB in the future, although data are presently only available for a limited time period.

**Scaling and Aggregation**

As discussed above, total effective consumption flows in the IEWB are calculated as the sum of personal consumption per capita (adjusted for changes in average household size), government services, and the adjusted relative value of leisure (less regrettable expenditure and

plus unpaid work where data are available), the total then being adjusted for changes in longevity of life. However, when aggregating the four components of the IEWB, the range of values taken by each component will implicitly weight the relative importance of that component in the overall index. Therefore, each component of the IEWB is normalized across all countries/province and years considered to take values in the (0,1) range. This is accomplished with the Linear Scaling Technique (LST), a break from the methodology used in earlier work on the IEWB in which each component was converted to an index (e.g. 1980=100) and the overall IEWB calculated as a weighted average of the four component indexes.[14] In the case of the consumption component, for example, the LST works as follows. An estimate is made of the maximum value that total consumption flows can take, namely the highest observed value in all years and in all countries/provinces considered plus 10 per cent of the range between the highest and lowest observed values. Likewise an estimate is made of the minimum possible value of total consumption by subtracting 10 per cent of the range between highest and lowest observed values from the lowest observed value. The 'Value' of total consumption flows in each year and for each country/province considered is then scaled according to the formula $\frac{\text{Value-Min}}{\text{Max-Min}}$. All scaled values will then lie between 0 and 1. This exact procedure is also applied to total stocks of wealth to calculate the scaled wealth component of the IEWB.

For the distribution and security components, however, the LST needs to be slightly modified, for two reasons. First of all, the sub-components of these two components are not expressed in value terms and so cannot simply be added up. And secondly, an index of income distribution, for example, should reflect the convention that increases are desirable – but increases in the Gini coefficient and poverty intensity reflect deteriorations in distribution within the framework of the IEWB. In the case of the income distribution component, the two sub-components are therefore scaled according to the formula $\frac{\text{Max-Value}}{\text{Max-Min}}$. The scaled poverty intensity and Gini coefficient indexes take values between 0 and 1[15] and show decreases when the underlying variables increase (representing a deteriorated situation). The overall (scaled) distribution component is a weighted average of the two scaled sub-components, with the relative weights based on individual subjective views on the relative importance of inequality and poverty.

Likewise, the four sub-components of the security index must be scaled before being aggregated into the overall scaled security component. Note that increases in the security from the risk of unemployment sub-component are desirable, while increases in the risk imposed by illness, risk imposed by single parent poverty and risk imposed by poverty in old age sub-components are undesirable. The appropriate LST formula is hence applied to each sub-component to ensure that the convention that increases are desirable is reflected in each case.[16]

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[14] See Salzman (2003) for a discussion of the LST and its application to the IEWB. David Longworth of the Bank of Canada suggested that this technique be applied to the IEWB some years ago, but this methodology, which will be used in all future work on the IEWB, has only been applied in recent calculations of the IEWB.

[15] Note that both variables take values between 0 and 1 in their unscaled form in any case, but that the LST serves to spread the scaled values over a larger portion of this range and so to take values consistent with the other scaled components of the IEWB.

[16] In previous work on the IEWB, the indexes of poverty intensity, the Gini coefficient, risk imposed by illness, risk imposed by single parent poverty and risk imposed by poverty in old age were all multiplied by -1 to reflect this

The four security sub-components can then be aggregated into the overall (scaled) security component using as objective aggregation weights the relative importance of the four groups in the population:

- For unemployment, the proportion of the population aged 15-64 in the total population.
- For illness, the proportion of the population at risk of illness, which is 100 per cent.
- For single parent poverty, the proportion of the population comprised of married women with children under 18.
- For old age poverty, the proportion of the population in immediate risk of poverty in old age, defined as the proportion of the population aged 45-64 in the total population.

The above proportions are normalized for all years to sum to unity. For example, the weights for Canada in 2001 were the following: unemployment (0.2763), illness (0.4127), single parent poverty (0.2142), and old age (0.0968).

The overall IEWB is then calculated as the weighted average of the four scaled components, with aggregation weights determined subjectively according to individual views on the relative importance of each.

Two types of comparisons are possible between countries/provinces based on the overall index or sub-components, namely changes in one country's economic well-being over time, and level comparisons, or rankings, of a country's level of economic well-being at a given point in time. For example, a higher value of the IEWB in a given year in country 1 compared to country 2 means that country 1 has a higher level of economic well-being than country 2, at least as measured by the IEWB. However, if country 1 has a lower value of the IEWB in 2000 than in 1995, for example, then country 1's level of economic well-being has deteriorated over this period, at least as measured by the IEWB. Note however that due to the range taken by the IEWB and its components it is more appropriate to look at absolute changes over time rather than percentage changes. This is because an equal improvement in the IEWB in absolute terms is reflected in a very large percentage increase for a country starting from a low level of the IEWB, but a very small percentage increase for a country starting from a high level of the IEWB.

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convention. The indexes were then expressed, for example, as 1980=(-100), so that a scalar, in this case 200, then had to be added in each year to make these sub-components consistent with the 1980=100 base of the other components and sub-components.

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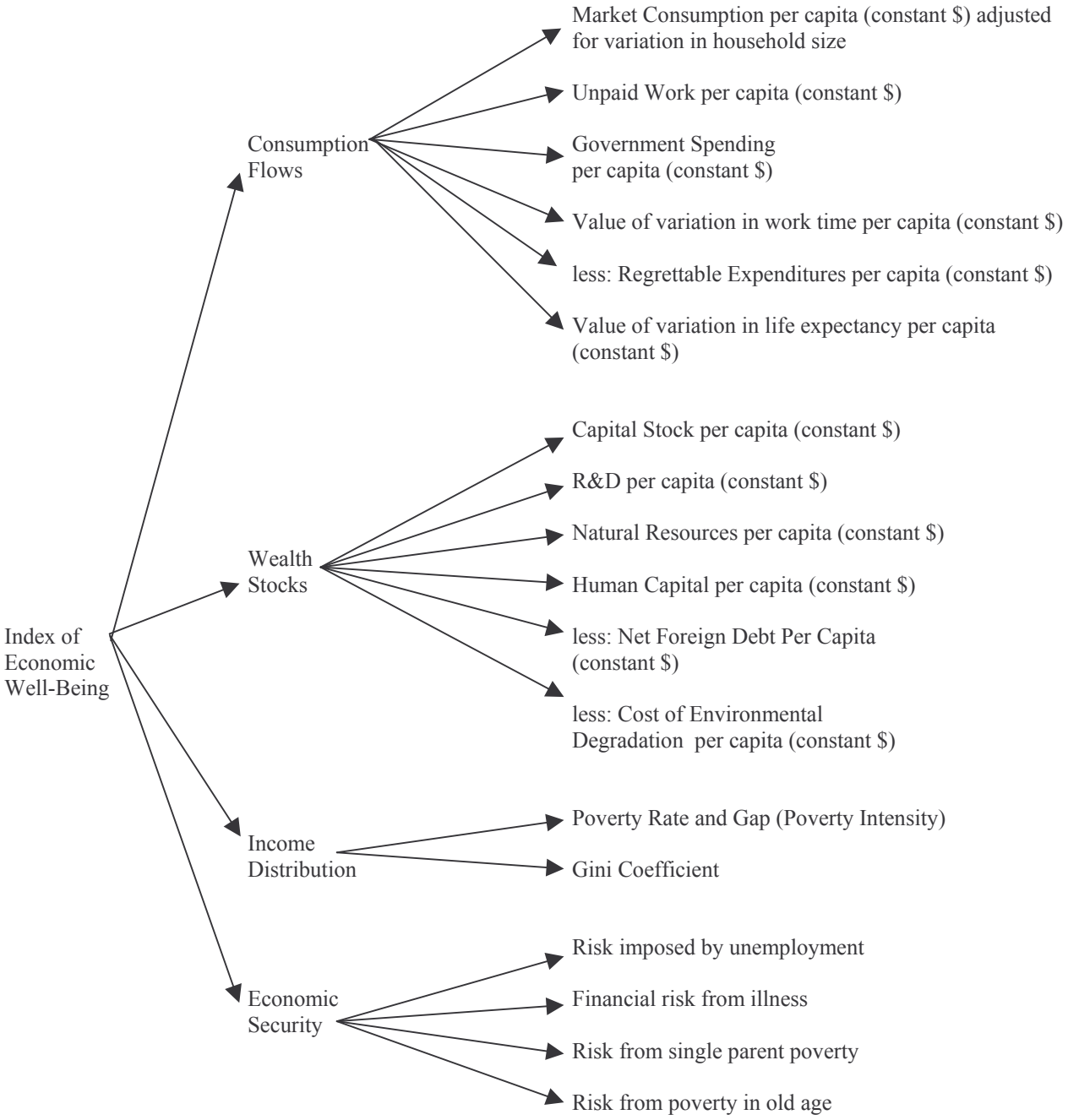
## Appendix: The CSLS Index of Economic Well-being



The formula for the overall index follows:

$IEWB = \alpha_1\{[C(HS)+G+UP+WT-RE](LE)\} + \alpha_2\{[K+ R\&D+HC+NR-D-ED]\} + \alpha_3[(\beta)\{LIM\}+ (1-\beta)\{GINI\}] + \alpha_4[(a)\{UR\}+(b)\{ILL\}+(c)\{SPP\}+ (d)\{OLD\}]$

where

{X} means that the Linear Scaling Technique has been applied to X

and

IEWB= index of economic well-being

C= real per capita personal consumption

HS= index of average household size relative to the base year and country

G= real per capita current government spending excluding debt charges

WT= real per capita value of variations in working time

UP= real value of per capita unpaid labour

RE= real per capita value of regrettable expenditures

LE= index of life expectancy relative to the base year and country

K= real per capita capital stock (including housing)

R&D= real per capita stock of research and development

NR= real per capita stock of natural resource wealth

HC= real per capita stock of human capital

D= real per capita net foreign debt

ED= real per capita social costs of environmental degradation (CO2 emissions)

LIM= poverty intensity (rate*gap)

GINI= Gini coefficient for after tax income

UR= security from the risk imposed by unemployment

ILL= risk to financial security from illness

SPP= risk from single parenthood poverty

OLD= risk from poverty in old age

$\alpha_1$, $\alpha_2$, $\alpha_3$, $\alpha_4$ = *subjective* weights for each of the components of the IEWB, $\alpha_1+\alpha_2+\alpha_3+\alpha_4=1$

$\beta$ = *subjective* weight placed on poverty intensity relative to the Gini coefficient

a, b, c, d = *objective* weights for the sub-components of economic security, a+b+c+d=1:

(a) is the normalized proportion of the population aged 15-64 in the total population

(b) is the normalized proportion of the population at risk of illness

(c) is the normalized proportion of the population comprised of married women with children under 18

(d) is the normalized proportion of the population in immediate risk of poverty in old age, defined as the proportion of the population aged 45-64 in the total population

Each of the security sub-components is itself comprised of a number of underlying variables:

UR= ER*BR*RR

where

ER= the employment rate

BR= the ratio of Unemployment Insurance beneficiaries to the number of unemployed

RR= the proportion of average weekly earnings replaced by weekly UI payments

ILL= HP/DISP

where

HP= total private expenditures on health care excluding medical insurance premiums and net of insurance reimbursement for medical expenses

DISP= total disposible (after-tax) income

SPP= DIV*SFLIM

where

DIV= the divorce rate (divorces as a proportion of all families)

SFLIM= poverty intensity (rate*gap) for households headed by single female parents

OLD= ELIM

where

ELIM= poverty intensity (rate*gap) for elderly-headed households