TOWARDS ESTIMATING THE IMPACT OF INTANGIBLE COST OF ILLNESS ON GDP: END-STAGE RENAL DISEASE IN TRINIDAD AND TOBAGO

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INTRODUCTION

- Intangible costs refer to the pain, anxiety and suffering and loss of quality of life that patients who have a disease (and their caretakers/family members) incur. The focus of this paper is the estimation of the intangible costs to **patients**.

- A scan of the literature shows that although many studies have been conducted on the economic burden of disease or the cost of illness, they focus in the main on tangible direct and indirect costs.

- Fewer studies attempt to estimate the intangible costs of disease using willingness to pay (WTP), Quality Adjusted Life Years (QALY) human capital approach and Disability Adjusted Life Years (DALY) methods.

INTRODUCTION

- What this framework does is to develop a methodology that links macroeconomic theory and health utility information in a novel way that makes the costing of the intangible cost of diseases possible.

- To develop our model we use the population of End-stage Renal Disease patients on dialysis in Trinidad and Tobago as our reference group.

- In 2010, there were an estimated 741 persons on dialysis in the country (Trinidad and Tobago. Ministry of Health 2010).

THEORETICAL AND METHODOLOGICAL FRAMEWORK

- The model estimates intangible costs by using the macroeconomic theory of potential Gross Domestic Product (GDP) as an entry point into the analysis, given its definition of fully employed resource use at normal (efficient) rates of utilization.

  $$GDP_e = A_e L_e^{\propto} K_e^{\beta}$$

  where:

  GDP_e is the full employment level of output;

  $L_e^{\propto}$ is the full employment labour force;

  K_e^{β} is the full employment capital stock;

  A_e is the technology used in production;

  $\propto$ *and* β represent labour and capital production factor elasticities; and

  e represents full employment

- We focus on the labour component of potential GDP which, according to the neoclassical framework means that at this point it is fully utilized.

- Our hypothesis here is that labour can only be **fully utilized** in its *most efficient capacity*, if it is experiencing a **perfect health state**. We also assume, therefore that it is only at this state that labour's maximum output can be achieved.

THEORETICAL AND METHODOLOGICAL FRAMEWORK

- While we acknowledge that labour productivity is not solely dependent on health, we also acknowledge that full utilization of labour and therefore potential output, cannot be achieved without it.

- Our main argument is that levels of income or output are generated at every health state, ranging from poor to perfect health.

- Since health states are reflective of how individuals function within a framework of pain and other “soft” or intangible conditions, and since a **perfect health state** is indicative of an individual’s **potential output generating capacity**, it therefore becomes possible to derive monetary values for deviations away from the perfect health state and potential GDP.

THEORETICAL AND METHODOLOGICAL FRAMEWORK

- We derive the health states and utility scores of ESRD patients as well as a matching cohort (MC) control group from the general population through the use of an EQ-5D questionnaire.

- We make the assumption that there is no bias in the control group from the general population and that if any person with ESRD was surveyed in this group, the impact on the results will be miniscule.

- The EQ-5D questionnaire is a widely accepted and used QoL instrument that is a "*generic quality of life instrument which has been extensively validated.*" The questionnaire measures health states by asking questions along five dimensions, mobility, self-care, usual activities, pain/discomfort and anxiety/depression, measured in an ordinal scale.

- Each question has three possible answers on increasing intensity for each item (1=no problem, 2=moderate problem, 3=severe problem). Therefore, the maximum score of (1,1,1,1,1) indicates the best health state, whilst a score of (3,3,3,3,3) indicates the worst possible health state.

THEORETICAL AND METHODOLOGICAL FRAMEWORK

- The mean EQ-5D utility score of both populations was calculated. These scores indicated how far both groups were from perfect health, that is, an EQ-5D utility score of 1.

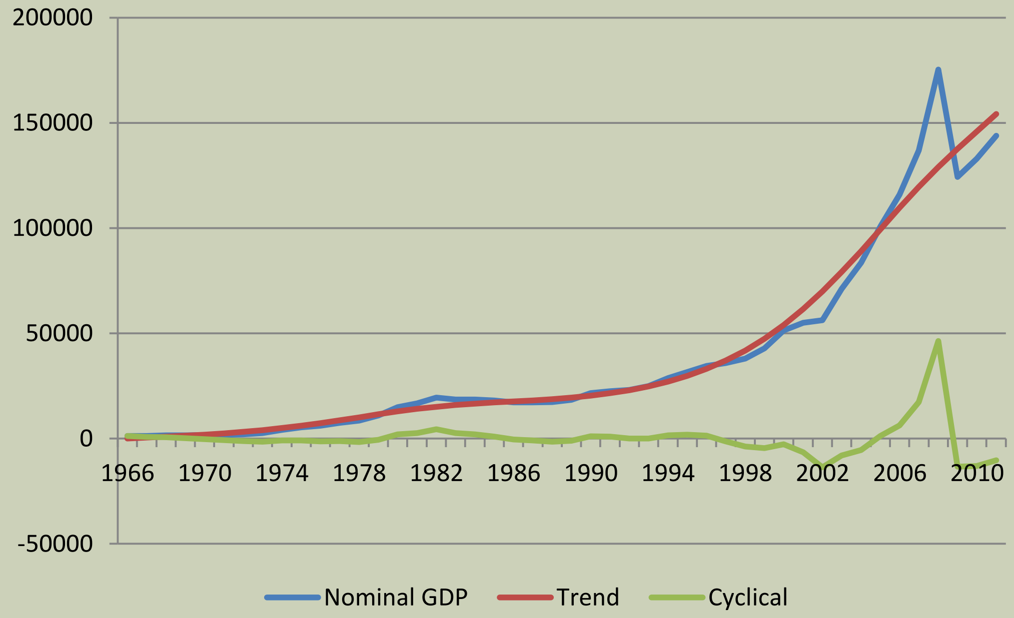
- It logically follows that the corresponding income point for a perfect EQ-5D utility score of 1, is potential income. Additionally, the mean EQ-5D utility score of the general population will be the actual GDP of the population (in other words, the equivalent income of the individual at the point of actual GDP).

- The difference between the income of the control group and the income of the ESRD patient group (at their calculated health utility points) will result in an estimate of the intangible cost of ESRD.

THEORETICAL AND METHODOLOGICAL FRAMEWORK

- The next step in our model involves the calculation of potential income for 2010. For this we use the Hodrick-Prescott filter, which is a univariate method that extracts the GDP trend.

Figure 1: Nominal GDP, Trend and Cyclical for the Period 1966-2011



THEORETICAL AND METHODOLOGICAL FRAMEWORK

- Given that per capita GDP is an average measure that does not incorporate distributional considerations, we explore the use of another measure through which we can incorporate distributional and welfare effects.

- For this we turn our attention to the use of **equally distributed equivalent (EDE) income**, which will allow us to equate values of income for individuals across households.

- Using equivalence scales we transform the heterogeneous general and ESRD populations to populations of homogenous equivalent adults. This scale is shown in columns one and two of Tables 1 and 2.

THEORETICAL AND METHODOLOGICAL FRAMEWORK

Table 1: Calculation of Equivalent Adults

Age Group	Adult Equivalent Weight	Population	Number of Equivalent Adults
0-4	0.5	94,074	47,037
5-9	0.7	91,285	63,900
10-14	0.83	87,920	72,974
15+ Female	0.83	527409	437,749
15+ Male	1	526675	526,675
Not Stated*		652	
TOTAL		1,327,363	1,148,335

Note: [1] <1 population, which has a weight of 0.02 population not provided in census report.

* Not Stated population omitted from total.

THEORETICAL AND METHODOLOGICAL FRAMEWORK

Table 2: Calculation of Equivalent Adults ESRD

Age Group of ESRD Sample	% Male/Female in ESRD Sample	Adult Equivalent Weight	ESRD Actual Population	Number of Equivalent Adults in ESRD Population
18+ Female	43%	0.83	319	265
18+ Male	57%	1	422	422
			741	687

RESULTS

- Fifty four percent (54%) of the ESRD patients experienced some problems with pain and discomfort (Level 2), while 45% and 38% experienced some problems with mobility and usual activities, respectively.
- With respect to Level 3, 11% of the patients reported extreme problems with conducting their usual activities.
- Twenty two percent (n=39) of the dialysis patients indicated an EQ-5D state 11111 ('full or perfect health' state with no problems on all 5 dimensions).

RESULTS

- In order to arrive at the EQ-5D utility index for both groups we make use of the EQ-5D DCE value set for Trinidad and Tobago developed by Bailey (2013) and recommended by EuroQol, the developers of the EQ-5D.
- The following table provides snapshot of the societal values/utility index for the various EQ-5D health states indicated by both groups. Since the index has interval properties we are able to use it as an axis of measurement in further analysis.

RESULTS

Table 4
Health States and Index Value of ESRD Patients and Matching Cohort (MC)

Health State	Number		%		Health Index Value
	ESRD	MC	ESRD	MC	
11111	39	43	22.7%	50.6%	1.0000
11112	7	1	4.1%	1.2%	0.8282
11121	13	16	7.6%	18.8%	0.8057
11211	6	2	3.5%	2.4%	0.7835
11122	9	1	5.2%	1.2%	0.7740
21111	4	2	2.3%	2.4%	0.7708
12112	1		0.6%	0.0%	0.7561
11212	1		0.6%	0.0%	0.7518
21112		1	0.0%	1.2%	0.7391
11221	6	1	3.5%	1.2%	0.7293
21121	11	6	6.4%	7.1%	0.7166
11222	6		3.5%	0.0%	0.6976
21211	1	1	0.6%	1.2%	0.6944
21122	3		1.7%	0.0%	0.6849
21212	2		1.2%	0.0%	0.6627
12221	1		0.6%	0.0%	0.6572
22121	1		0.6%	0.0%	0.6445
21221	12	4	7.0%	4.7%	0.6402
11231	2		1.2%	0.0%	0.6345
21312	2		1.2%	0.0%	0.6215
21222	9	4	5.2%	4.7%	0.6085
21321	1		0.6%	0.0%	0.5990
22221	1		0.6%	0.0%	0.5681
21322	2		1.2%	0.0%	0.5673

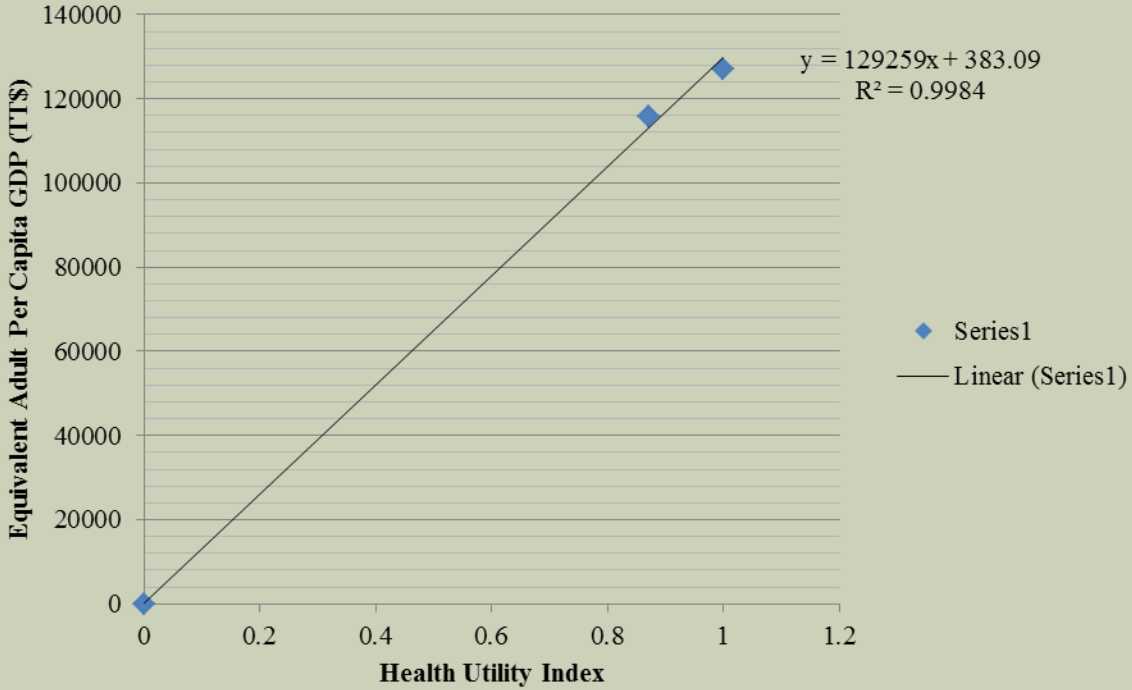
RESULTS

- Based on the results of the building blocks of the model we have a general population of homogenous equivalent adults each with a mean health utility score of 0.87 who generated total actual GDP of TT$132,960.6 million in 2010.
- Estimated potential GDP for that year was calculated to be TT$145,928.8 million, with a resulting GDP gap of TT$12,968.2 million.
- Further, we also have an ESRD sub-population of homogeneous equivalent adults each with a mean health utility score of 0.73.
- Based on our theoretical framework, the proportion of the deviation away from a perfect health score of 1 that can be attributed to the ESRD population will be the difference between the health utility score of the general population and the ESRD population.
- This same logic is applied to any deviation away from potential income (GDP).

RESULTS

- The adult equivalent per capita nominal (actual) and potential income points were plotted on a graph against the health utility index variable.

Figure 2: Relationship Between Equivalent Adult Per Capita GDP and Health Utility Index (2010)



RESULTS

- The line equation for the graph is:

$$y = 129259x + 383.09.$$

- Solving for an x of 0.73 we arrive at equivalent adult per capita GDP for an ESRD patient of $94,742.16. With the equivalent adult per capita GDP of $115,785.59 for the general population, this leaves us with a difference of **$21,043.43**, **which is the intangible cost of ESRD for an equivalent adult.**

- Additionally, the population of ESRD patients was estimated at 687 equivalent adults in 2010. The data we have derived allows us to estimate of the intangible costs of ESRD is estimated at **TT$14.46 million or US$2.27 million**.

RESULTS

- Using data from costing studies done for Trinidad and Tobago by the HEU, Centre for Health Economics for that year, the ***least cost estimate*** of the total cost of ESRD (institutional and intangible costs) was TT$171.4 million or 5% of public health expenditure.

- While the intangible costs amount to 8% of the estimated total cost of ESRD, what this translates to at the individual level, is 18% of equivalent adult individual income for 2010 and .01% of GDP.

- For the individual this represents a substantial cost and is indicative of the intensity to which pain and suffering can impede productivity.

RESULTS

- More importantly, the methodology can be applied to determine the impact of the intangible costs of NCDs as a group, making the relevant adjustments for co-morbidities. Since the methodology estimates the intangible costs from a patient perspective, there is still room for the estimation of these costs from the perspective of care givers and family members.

- This can allow us to have some sense of the impact of the intangible cost of the leading causes of morbidity and mortality in the country.

END OF PRESENTATION