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CHAPTER VI – EVALUATION OF INTANGIBLES

I – INTRODUCTION

The measurement of intangibles (such as noise from airport an pain from medical treatment) is essentially a **shadow pricing** issue.

Intangible means "*that there is a difficulty to put a monetary value on an effect or a consequence*".

When you deal with intangible you start to **put a physical value** on the effect and then you put it into a **monetary value**. Here is the difficulty. We are in the **field of shadow prices** because we have an **effect** and the **market does not put a price on it.**

Market prices for intangibles often are absent and this forces more **indirect valuation** methods to be used.

The **reason why markets do not exist** is often a product of the pure **public good properties** (joint supply and rice non excludability) of intangible items.

But a useful distinction is to consider the **jointness** involving the provision of different products (transport and noise) to the same consumer rather than the same product simultaneously to different consumers. This explains wry much of the analytic concerns how best to deal with this composite commodity valuation problem.

II – REVEALED PREFERENCES

We will first **focus on the revealed preference approaches** which are the most commonly used.

As we shall see, there are **two mains approaches**.

- One, such as **the travel cost** methods tries to tackle the evaluation in an **aggregate form** and combine elements in the evaluation step.
- The second, as with **the hedonic pricing method**, tries to **disaggregate** effects, so that **individual component** can be valued separately.

2.1 – travel costs

The principle behind the travel cost method come from Clawson (1966)[1]

How does one value an outdoor are (a park for example)?

The general idea is that you **take the visit as a unit** and you assume that the people visiting the **park pay for the visit by the cost of the travelling to the area.**

[1] Clawson (1966) « Economic of outdoor recreation » Washington DC, John Hopkins.

- The **first stage** is to collect data on the visitors. There are **four locations** and visitors numbers.

Assuming a constant cost per miles of 50cents, the travel costs of the four communities are listed in the last column of the next table.

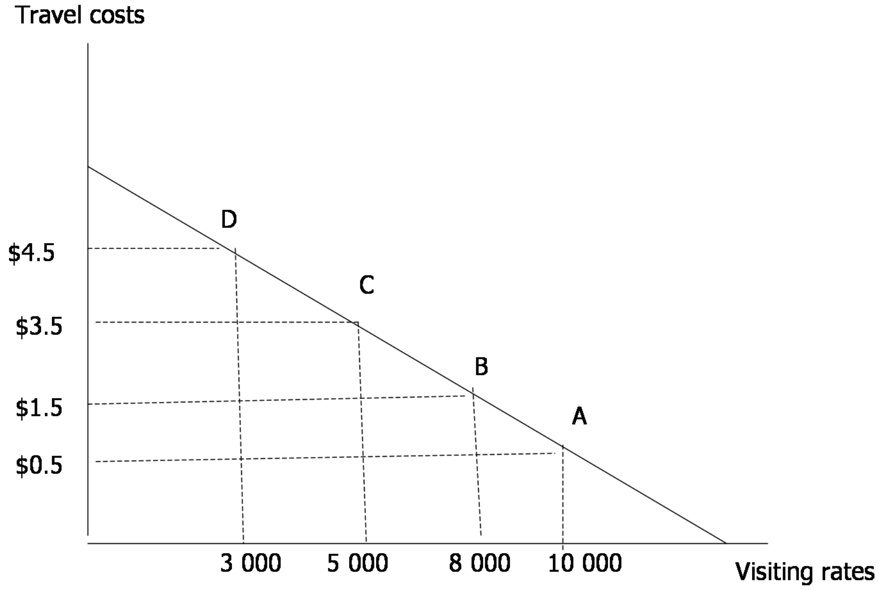
The **travel costs constitute the implicit prices** paid by the communities to go to the site.

Figure 1 – Community visiting rates and travel costs

	Visitors rate	Distance	Travel costs
A	10.000	1	0,5
B	8.000	3	1,5
C	5.000	6	3,3
D	3.000	9	4,5

The first state is completed by relating the visiting rates to the travel cost (fig 3).

Figure 2. Travel costs and visiting rates



- The starting point of the **second step** is the **assumption that any explicit charge that is made is treated like an increased in travel cost**.

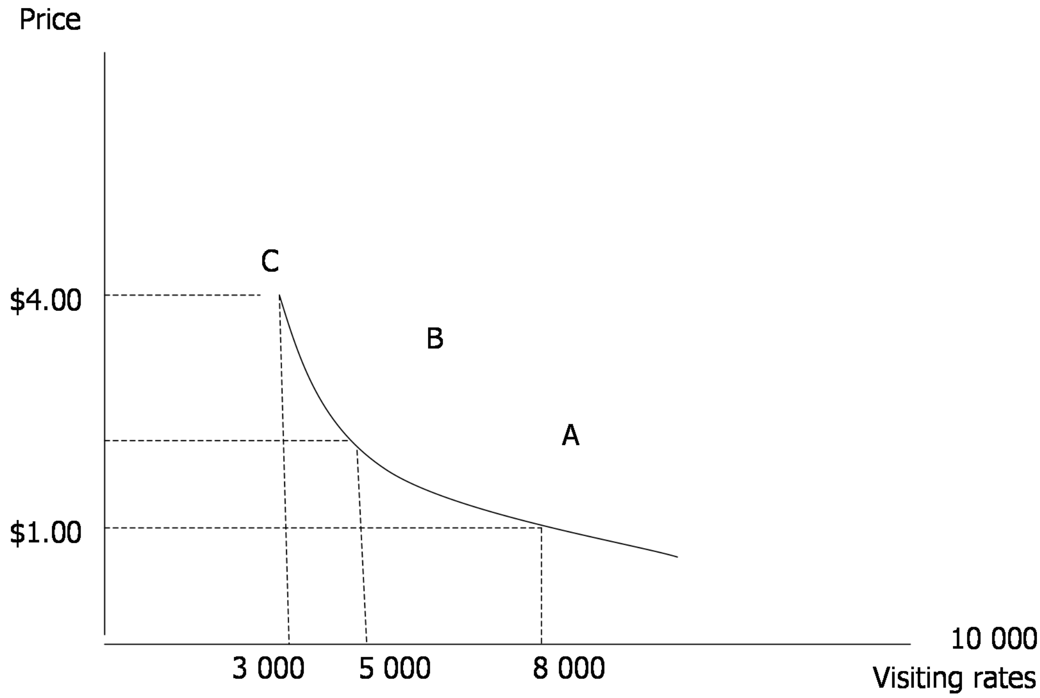
This means that the **visiting rate for a community facing a particular positive price is the one that corresponds to a community with higher travel costs of he amount.**

To see how this works say one is considering to charge a community A is a price **of $1 for a visit.**

The total cost would be $1.5, being the sum of the $0.50 travel costs and the $1 price.

One now has the point A on the demand curve on fig 4.

Figure 3. Prices and visiting rates



On the **previous diagram**, we see that for community B that had a travel cost of $1.50 the visiting rate was 8 000. **This figure is then assigned to community A** as the visiting rate for the price of $1. One now has the point A on the demand curve.

The other two points continue the process used to derive point A. In both case community A respond to a particular price increase by providing the visiting rate of the community with the equivalent travel cost.

Point B has a price of $2 and a visiting rate of 5 000 (this being a total cost of $3.5 which a community C faced and responded to with a 5 000 visiting rate). Similarly, point C has a price of $4 and the visiting rate of 3 000. Joining up points A, B and C produces an **estimate of the demand curve** for the site activity.

This technique is very easy but relies on the assumption of the **homogeneity of individuals** and of **the mean of the transportation**.

2.2 – Hedonic prices (HP)

The origin of **hedonic pricing** goes back to **Lancaster theory** of consumer choice. This says that people buy goods because of the **characteristics** of attributes those goods posses.

Hedonic prices are "*the implicit value that underlie each characteristics of a product that provide pleasure or satisfaction*".

The methodological contribution of hedonic prices to CBA is that it deals with the fixed quantity consumption property of public goods that make them so hard to value.

With **pure public goods**, each individual **receives the same quantity. This makes it difficult to estimate what people are willing to pay for additional units**.

The way hedonic pricing tackles this problem is to **replace the quantity dimension with one based on quality.**

- **For example**, in the study of 5 500 licensed fisherman in Washington state un the United State by Brown and Mandelshon[2], prices for the individual components were estimates by the hedonic pricing method. A site was defined as the river used for fishing.

Three prime characteristics of a fishing site were identified as: the scenic value, the crowdness (lack of congestion) and the fishing density in the river.

The scenery and crowdness attributes were leisured on a scale of 1 to 10, were 1 was the worst and 10 was the best.

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[2] Brown G. & Mandelsohn R. (1984) "The Hedonic Travel Cost Method" *Review of Economics and Statistics*, 66, 427-33.

Fish density was the average fish caught per day. For each characteristics, the mean values for all fisherman surveyed were used, rather than the individual judgment themselves.

It was thought that the average would be a more objective index of a site quality. **The average across all site was 5** (per ten days) for **fish density**, **4,5 for scenery** and **4 for lack of congestion**.

The **difference between an average site and excellent site** was **one unit** for both the scene every and crowdness characteristics and **two units** for fish density.

The value placed on the prime characteristics depended how long was the trip.

Brown Mendelshon **distinguished three trips duration**; 1 day, 2-3 days, and 4 days ad over (4+).

This meant **that effectively there were nine characteristics of a trip**, as there were **three durations for each of the three prime characteristics**. A fishing trip involves two simultaneous choices.

An individual must decide **how much quality** (quantity of attributes to purchase on a given length trip, and **also how many trips to take of each length**. Estimation proceeds in two steps.

- The **first step** involved **deriving the hedonic price**.

This step can be thought in terms of **extending the travel cost model. Different costs of visiting sites define the travel costs implied with each characteristic.**

The idea was that a **person would have to spend more time** in **addition to extra expenses** when travelling distant site in order to enjoy greater amounts of the attributes.

Different distanced sites, with alternative combination of characteristics, thus the reveal different characteristics prices.

The **hedonic prices from the first step were regressed on the characteristics**.

- This **second step** involves finding the **inverse demand function**.

For the **regular demand function**, the quantity demanded of a particular characteristic is he dependant variable and price, income, and so on, would be the independent variables.

For the **inverse demand function**, **one has the price variable** (i.e the hedonic price) **as the dependant variable and the independent variable are the quantities id the characteristics.**

The regression coefficient of the characteristics of the inverse demand function therefore **indicates the contribution of each attribute to the hedonic price.**

The next table reports the result for the 1 day trip category which constitute 80% of the sample.

There are **three equations (rows)** because the price for each prime characteristic (the dependant variable in each regression) is determined separately.

The **own price effect** (**the relation between the hedonic price and the quantity of the characteristic** whose price has been determined) are **all negative** as microeconomics would predict.

In an **inverse demand curve framework**, these **negative own price effect translate into the statement: the more a fisherman experience any particular characteristic, the less he is willing to pay for additional units.**

When these **coefficients are divided by their sample means**, they produce **price elasticity estimates.**

The demand for fish density was elastic (-1.22). For longer trips the demand became less sensible to price. For example, the -1.22 own price elasticity figure for 1 day trip falls to -0.44 for 2-3 days trip.

Figure 4. Determinant of hedonic prices for 1 day trips

Variable	Scenery	Lack of congestion	Fish density
Constant term	-4.505	21.528	55.779
	(-1.22)	(4.89)	(2.39)
Income	-0.000	0.000	0.0033
	(0.70)	(4.35)	(15.07)
Experience	0.170	0.119	-1.400
	(7.45)	(4.36)	(9.66)
Scenery	-3.039	1.370	-1.011
	(6.26)	(2.36)	(0.33)
Lack of	1.482	-4.621	7.270
congestion	(4.06)	(10.61)	(3.14)
Fish density	-11.348	-2.540	-141.62
	(550)	(1.03)	(10.83)
No. 1-day trips	0.440	0.636	5.380
	(6.12)	(8.16)	(12.99)
No. 2-4 day trips	-2.873	-0.251	20.582
	(8.17)	(0.59)	(9.23)
No. 4+day trips	-4.752	-14.1318	5.628
	(6.56)	(16.56)	(1.23)

Source: Brown and Mendelsohn (1984)

The fishing case study explains precisely how pricing take place for public goods.

One start off by contemplating a particular outdoor recreation site, which has joint supply and non-excludability. **The possibility of travelling to a more distant site enables one to transform the joint supply property into separate supply.**

This transformation is bought at a price. The travel and time cost involved with the greater journey distance is the mechanism by which price exclusion now takes place.

If one **does not pay the travel cost**, one **does not get the separate supply**.

III – DECLARED PREFERENCE: SURVEY EVALUATION (i.e CONTINGENT VALUATION

When population around a site are very sparse, the hedonic pricing method cannot be used. One advantage of **contingent valuation surveys** is the flexibility it provides.

3.1. Clean air in LA

Questions needs not relate only to experiences or situation that have actually occurred. One can probe not hypothetical situations using ‘thoughts experiments’.

The **levels of air pollution** in metropolitan LA were measured by reading in terms of nitrogen dioxide (NO2) and to suspended particles matter (TSP). **Three pollution regions** were identified.

A ‘*good*’ pollution region had NO2<9 units and TSP<90 units; *‘fair’* pollution was NO2 = 90-110 units, and ‘*poor’* was NO2>9-11 units and TSP>90-110 units.

3.2. Clean air in LA. The Survey approach (WTP)

To correspond with the survey questionnaire, the sample was divided into two groups. One group had households contemplating a move from a ‘poor’ to a ‘fair’ region; and the other from ‘fair’ to ‘good’.

A **hypothetical market** for clean air was posited and people were **shown photographs depicting different levels of visibility** to help appreciate difference between poor, low, and high pollution region; alternate price levels were specified and response to these were recorded.

The **basis for the bid** was an **improvemen**t from exiting pollution level in the area in which a person was residing.

Two types of bids were presented, for improvement from **poor to fair**, and from **fair to good**. A total of 290 completed surveys were obtained over the period of March 1978.

The **mean bid as a whole** was **$14.54** for the improvement from **poor to fair**. **And $20.31** for the improvement from **fair to good**.

Figure 5. The effect of pollution WP

Community	Change in WTP
Poor-fair	
El Monte	11.10
Montebello	11.42
La Canada	22.06
Sample population	*14.54*
Fair-Good	
Canoga Park	16.08
Huntington park	24.34
Irvine	22.37
Culver city	28.18
Encino	16.51
Newport beach	5.55
Sample population	*20.31*

IV –SURVEY EVALUATION VERSUS HEDONIC PRICING

It is interesting to see the extent to which **survey evaluation** and **hedonic pricing** are **interchangeable** as measurement techniques.

4.1. Clean air in LA. Hedonic pricing of houses (HP)

We take the **same example**: clean air in LA and use the hedonic pricing method to check id there is a difference.

The hedonic pricing situation under examination is one where **difference in house prices (or rents) is being used to reflect different differences in environment quality (air pollution**).

The quantity the effects of changes in P on changes in property values,, one needs **to hold constant other characteristics** of a house and its location.

- Nine communities that were considered to be homogeneous apart from the air pollution levels were identified.

The list of independent variables in the hedonic regression equation were: housing structure variables (sale date, age, living area, the number of bathrooms and fireplace, existence of a pool, neighbourhood variables (crime, school quality, ethnic composition, housing density, public safety expenditures) accessibility variables (distance to beach and employment); and the air pollution variables (NO2 and TSP).

The **dependant variable was the (log of the) home sales price. 90% of the variation in home sale prices was explained by the set of independent variables**.

The coefficient **attached to the pollution variables** in the equation with the NO2 index for the communities and for the two discrete pollution changes is reported in the second column of the next table.

The data came from a sample of 634 sales of singles family house between January 1977 and March 1978.

Figure 6. The effect of pollution on rents

Community	Change in rent
Poor-fair	
El Monte	15.44
Montebello	30.62
La Canada	73.78
Sample population	45.92
Fair-Good	
Canoga Park	33.17
Huntington park	47.26
Irvine	48.22
Culver city	54.44
Encino	128.46
Newport beach	77.02
Sample population	59.09

We can se that the extra rents paid were **$45.92** per month in the sample as a whole for an improvement in air quality from **'poor' to 'fair'**.

The corresponding figure for the movement from '**fair' to 'good'** was **$59.09** per month.

Brookshire and al. reports that the high figures for improvement were in **higher income** communities.

4.2. Comparison WTP versus HP

Brookshire et al. (1982)[3] tested the extent to which **survey and hedonic pricing can validate each other** in the context of measuring the benefits of reduced air pollution in Los Angeles**.**

In every case of fig 8 (show column 4) the **difference are positive** an statistically significant. This suggests **the main hypothesis that the hedonics prices (rents) figures exceeds the prices estimated by survey.**

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[3] Brookshire D.S ; Thayer MA ; Schulze WD ; D'Arge RC (1982) « Valuing Public Goods : A Comparison of Surveys and Hedonic Approaches » *American Economic Review*, 72, 165-177.

The hypothesis under test is this: an estimate of the value of a reduction in air pollution using **hedonic pricing** will be significantly **higher** that one using than a **survey approach**.

Figure 7. The effect of pollution on rents

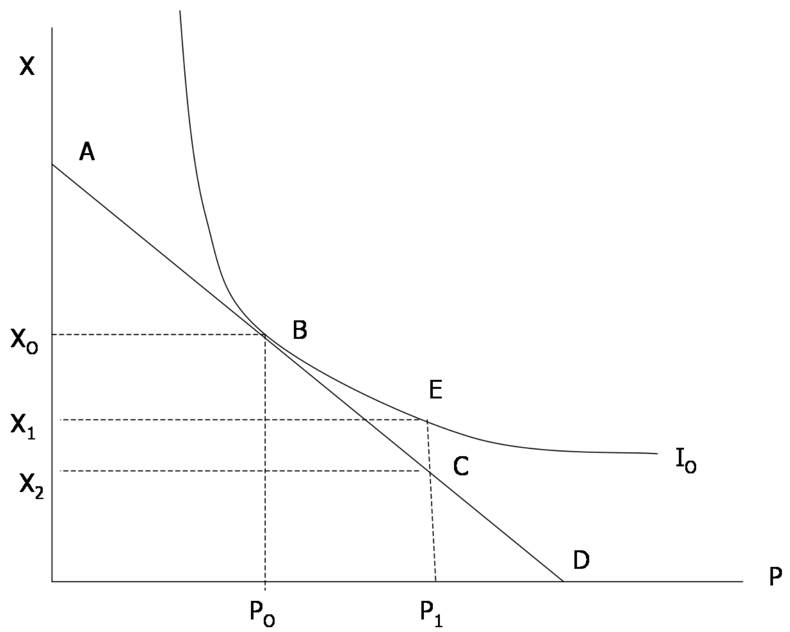
Community	Change in rent	Change in WTP
Poor-fair		
El Monte	15.44	11.10
Montebello	30.62	11.42
La Canada	73.78	22.06
Sample population	45.92	*14.54*
Fair-Good		
Canoga Park	33.17	16.08
Huntington park	47.26	24.34
Irvine	48.22	22.37
Culver city	54.44	28.18
Encino	128.46	16.51
Newport beach	77.02	5.55
Sample population	59.09	*20.31*

What was important about this case study was that a presented reason **why hedonic prices would overstate the true WTP** for clean air.

4.3. Explanation

We supply a simplified version of their analysis contained in the next figure.

Figure 8. Clean air in LA



Let clean air be represented by P. Assume that the only way that an individual can purchase any of its, is buying housing in location subject to less pollution.

The rents for this housing is denoted by R. With a fixed income, the more one spends on housing the less one has available to devote to other goods X.

X is the money left to buy other goods. X is measured in dollars (it price is assumed to be equal to unity) and it is the numeraire in the analysis.

The choice is between P and X, and the budget constraint is adjusted to allow for the fact that as one purchase more clean air, one spend more on R and has less to spend on X.

On the diagram the **budget constraint** is for simplicity drawn as a strait line (has a constant slope).

Movements **along the budget line indicate the implicit market for clean air**.

The **slope** (called the rent gradient) measures **the higher housing costs paid for location in areas with lower pollution**.

The indifference curve indicates all the basket of X and P which provide the same level of utility, say I_O.

Moving on the indifference curve means that the utility is constant while you change the content in X and P of the basket.

Moving on the budget line means that you trade between X and P within the constraint of your budget and according to the relative prices of the good.

a- Hedonic price. The **hedonic price** for an **improvement** in air quality from **P_O to P_1** corresponds to movement from **B to C** and **amounts X_OX_2**. I

b-Survey method. if we ask the question of how much of X is one **willing to pay** to move from **P_0 to P_1**, we obtain a **much lower amount**. The initial equilibrium is **at B**, where the indifference curve I_O is tangential to the budget line P_O in X_O is the initial consumption of the two goods. When we ask the question how much a **person is willing to pay** to obtain the higher level of clean air P1, **one is moving from B to E.** At E consumption is P_1 and X_1 **The amount X_OX_1 is the WTP** for the change from P_1P_2.

The **rental price** exceeds the true WTP by the **amount X_1X_2.**

Figure 9 make clear one reason why the **hedonic approach overstate** the true value is that the **income effect** are not being hold constant in the measure involving the rental gradient.

The **true** measure moves the individual along the indifference curve. This is **like responding to a change in price, holding income** (that is utility constant.

The **property value approach** moves one **along a price quantity equilibrium path**, without **holding income** constant. So the rental gradient is clearly **not a compensated variation**.

V – VALUING LIFE

The two traditional methods of valuing life are either variants of the **human capital approach** or based on the **willingness to pay** approach.

5.1. Human capital approaches

There are two main variants of the **human capital approach**.

They measure the value of **people's lives by their contribution to the economy**.

They measure the value of people's lives by their contribution to the economy. **Method I** looks at the economy in terms of national income. At the individual level, a person's contribution is the present discounted value of future earnings over one's expected lifetime.

The second human capital approach was similar to the first except that is required deducting from earnings all the consumption that people make over their lifetime. The assumption is that it is the earnings less consumption that the rest of society misses when a person dies.

The human capital approach has the advantage that is **simple** to interpret and data are readily available on this basis.

However, as stressed by Mishan (1976)[4] **neither of the traditional methods corresponds with the individualistic value judgement** behind CBA. CBA is built on the assumption that individual preferences are to count. The **human capital approach** looks at the **effect on society** and **ignores the preferences** of the individuals whose life is at issue.

It is often the case that only a small subset of the population is likely to lose their life due to the public project. Dividing this number by the population produce the probability that a person will lose his life. It is preferences over risky outcomes that should therefore be the basis for making evaluation of the loss of life.

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[4] Mishan E.J (1976) "*Cost Benefit Analysis*" New York, Praeger.

5.2. Willingness to pay approach

Schelling (1968) [5]consequently argued that is **a statistical death** that one is contemplating, **not a certain death** (who value could be thought to be **infinite**).

By considering what individuals **are willing to receive as compensation for putting up the risk of death**, Schelling provided an **individualistic mechanism** for measuring the value of life.

Schelling was careful to distinguish situations **where actual lives where at stakes** from those **where an anonymous person's life is at stake** (which is the statistical life framework).

When the individual **identity is known** (as when donations are sought in the newspaper to help finance an expensive treatment that will save the life of a named person) **valuation are likely to be much higher** that when applying a small risk probability to a large impersonal aggregate of people to obtain a life that is predicted to be loss.

- There have been **two major studies** that have used this willingness to pay approach. Thaler and Rosen (1975) [6]analysed the **risk premium included in the wage differentials of riskier form of employment**.

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[5] Schelling T.C (1968) "The Life You save May Be Your Own" in Chase, S.B. J (eds), "*Problem in Public Expenditure Analysis*", Washington DC, Brookings.

Blomquist (1979)[7] looked at **people's trade-off of time used in using a seat belt** (valued by the wage rate) given the extra risk of being fatally injured during an accident.

In both cases they came up with an estimate value of life of **$390000**. This valuation **was remarkably close to the fist human capital approach**.

VI– CONCLUSION

There are other methods of evaluating the intangibles. **Social Cost studies** (COI) are quite important in the field of health economy. They give a magnitude to a problem. Social cost studies are based on the idea that an illness or a social problem destroys some resources.

These approaches are not directly linked to Cost Benfit Analysis because they only focus on the cost side, which makes sense for evaluation the impact of cancer or mental illness. It is more controversial when assessing the cost of alcohol or tobacco which also produces some benefit (utility).

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[6] Thaler and Rosen (1975) "*The Value of Saving a Life*" in Terleckyj, NE (ed) NBER.

[7] Blomquist G. (1979) "Value of Life Saving; Implication of Consumption Activity" *Journal of Political Economy*, 87, 540-58.

VI – EXERCICES

Le parc national de Jellystone est situé à 10 minutes de la ville A et à 20 minutes de la ville B. Chacune de ces villes compte 200 000 habitants, et leurs résidents ont tous les mêmes revenus ainsi que les mêmes préférences concernant les parcs nationaux.

On suppose que pour un individu, le coût d'entrée du parc est équivalent au temps nécessaire qu'il met pour se rendre au parc national. On suppose également qu'une minute de temps coûte 0.50$ aux habitants des deux villes.

On observant le comportement des habitants des villes A et B, on constate que les habitants de la ville A se rendent au parc dix fois par an, alors que ceux de la ville B ne s'y rendent que cinq fois par an. On fait les hypothèses suivantes : Seuls les résidents des villes A et B se rendent au parc ; le coût annuel de fonctionnement du parc est de 1 500 000$; le taux d'escompte social est de 10%. On suppose enfin que le parc a une durée de vie infinie.

Calculez le coût d'une visite pour chaque habitant des deux villes.

On dispose des deux observations suivantes : 1) le coût d'une visite, ainsi que le nombre de visite effectuées par un habitant de la ville A ; 2) le coût d'une visite, ainsi que le nombre de visite effectuées par un habitant de la ville B. On suppose que ces deux observations correspondent à deux points situés sur la même droite (linéaire) de demande de visite. Dérivez la (fonction) courbe de demande. Quel est le surplus du consommateur pour chacune des deux villes. Quel est le surplus total du consommateur ?

Un promoteur désire acheter Jellystone, et offre 100 million $. Le parc doit-il être vendu ?