Introduction of Health Economics

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Outline

- Why economics for healthcare services?
- Some basic economic concepts
- Measuring economic cost
- Measuring health outcomes
- Basic types of economic evaluation
- Some Related Health Economic Policies

Learning Objectives

- To understand some basic concepts of health economics
- To understand the principles and importance of economic evaluation
- To understand the framework of different types of economic evaluation

Why Economics for Healthcare?

- The scarcity of resources and healthcare resources
- Alternative use of healthcare resources exist
- Increasing Demand for Value
- Increasing Demand for Accountability

Scarcity of Health Resources

- **Health resources**
  - Everything inputted in the delivery of a specific treatment or intervention
    - Medical personnel time, equipment, drugs, patient time,…
- **Scarcity**
  - In comparison with needs or demands
  - Scarcity means choices and distribution
    - Suppose the community have only $1 million, at least three main public health problems need financial support and each one will consume $0.6 million. The decision?
  - Scarcity means trade-off

Key Questions due to Scarcity

- Which goods and services to produce (toward which health problem)?
- How to produce a given level of goods and services (what kind of interventions)
- Who gets the goods and services ?
- Equity issues
- Health Economics is helpful to answer these questions

Demand for Value and Accountability

- "Value" is the combination of cost and health outcome
- Patients increasingly want to know
  - Whether the services provided necessary?
  - Whether the services provided appropriate?
- Health professionals must be ready to answer these questions.

What is Health Economics?

- Health economics is a theoretical framework to help healthcare professionals, healthcare decision-makers, or governments, to make choices on how to make the best use of limited health resources

What is Economics?

- The study of how individuals and societies choose to employ scarce resources that could have alternative uses in order to produce various commodities and to distribute them for consumption, now or in the future, among various persons and groups in society. (Samuelson, 1992)

What is Economic Evaluation?

- Economic evaluation
  - Systematic method to determine whether healthcare resources are spent efficiently
  - Seeks to define a set of explicit criterion, so to facilitate the allocation decision of limited resource in different fields

Some Basic Concepts in Economic evaluation

- Opportunity cost
- Marginal analysis (incremental analysis)
- Time preference
- Economic Efficiency

Opportunity Cost

- The cost of a good or service as measured by the alternative uses that are forgone by producing the good or service
  - Want more physicians? Be prepared to accept fewer scientists or teachers.
  - In economic evaluation, the opportunity cost is the same as total illness cost (or economic cost) of a treatment.

Marginal Analysis

- Marginal benefits are those resulting from small changes in inputs.
- Marginal costs are costs needed to output one additional units of the same goods or services.
- Law of diminishing marginal benefits
- Law of increasing marginal cost
  - Example: Screening women once a year for cervical cancer may yield a high average benefit per dollar of cost, screening women twice a year will not necessarily be twice as productive---the marginal benefits decreased

Total Cost	Benefits (imm. Children)	Average benefit per dollar	Marginal benefit per dollar
20000	100000	5	
40000	160000	4	3
60000	200000	3.33	2
80000	240000	3	2
100000	260000	2.6	1

Total Cost	Benefits (imm. Children)	Average benefit per dollar	Marginal benefit per dollar
20000	100000	5 **(100000/20000)**	
40000	160000	4	3 **(160000-10000)/(40000-20000)**
60000	200000	3.33	2
80000	240000	3	2
100000	260000	2.6	1

Using marginal analysis to maximize outcome

- In a given health program, only if marginal benefit is greater than marginal cost, the activity should be expanded to maximize the total benefit
- Among different activities, only if marginal benefits of each activities is equal, resources are allocated optimally and the maximum total benefit is reached

Time Preference

- Refers to the rate at which people discount the future relative to the present.
  - Suppose different choices can bring the same benefit, but in different time, generally most people prefer the nearer one (with or even without inflation or interests).
  - Individuals with high rates of time preference will tend to invest less in the future, on average they will have less education and worse health.
- Concept of present value
  - The value of future dollars discounted back to the present day to take account of the time preference.

Adjusting for Time Preference

- When compare cost and benefit in economic evaluation, time preference adjustment must be made to obtain a true result.
  - Suppose the benefit in 2024 is $20,000 at a discount rate of 5%, its present value (in 2004) is only $7500 (at compound interest)

- Suppose two programs, A and B. (interest rate 5%)

year	Cost of A	Cost of B
1	10	25
2	15	15
3	20	4

  - Which program consume more cost, in the view of present value?

- Suppose two programs, A and B. (interest rate 5%)

year	Cost of A	Cost of B
1	10	25
2	15	15
3	20	4
	45	**44**

$NPV=C/(1+r)^0+C/(1+r)^{1+}C/(1+r)^2+\ldots+C/(1+r)^{n-1}$

Programs A $= 10/(1+0.05)^0+15/(1+0.05)^1+20/(1+0.05)^2=$ **42.42**

Programs B $= 25/(1+0.05)^0+15/(1+0.05)^1+4/(1+0.05)^2=$ **42.91**

Economic Efficiency

- The best use of resources to achieve an objective, either treating the maximum number of patients or producing the maximum health gain.
- Productive efficiency
- Allocation efficiency: Pareto optimality

(Pareto optimality: no one can improve welfare without one reduce welfare)

MU1=MU2= ….. =MUn)

Framework of Economic Evaluation

- Perspectives
- Define aims of evaluation
- Identify choices of intervention
- Measuring costs
- Measuring outcome
- Connecting costs and outcome

Personal vs Social Perspective

- A health program might be cost-effective from the individual's perspective, but may not be cost-effective from the social perspective
- Generally, economic evaluation start from social perspective

Define Aims of Evaluation

- Outcome evaluation
  - How many cancer detected?
  - How many patients cured?
- Cost evaluation
  - How much spent for this intervention?
- Cost-outcome evaluation
  - Combine the cost evaluation and outcome evaluation

Identify Choices

- Particular disease
  - Medication only
  - Surgery
- Community screening program
  - Old test
  - New test

Measuring Cost

- What cost items should be included in evaluation?
  - Old thinking only include direct cost of medical treatment? Is it logical?
  - Perspective: patient, provider, insurer, society
  - What is your opinion?

Concept of Economic Cost

- What providers and society give up to provide treatment for an individual is called the **total cost of illness**, which is the same as the economic cost (or opportunity cost) of a treatment.
- Different from old thinking of only including direct cost of providing a treatment

- **The total estimated cost of asthma in the US in 1985 was about $4.5 billion.**
  - Direct medical expenditures $2.4 billion
  - Indirect costs exceed $2 billion
- **Depression in US costs society about $44 billion annually**
  - Almost three-quarters of the costs are indirect and result from a combination of reduced productivity and lost earnings due to depression-related suicides

- **Direct cost** include the value of all the goods, services, and other resource that are consumed in the provision of an intervention or in dealing with the side effects, or other current and future consequences linked to it
- Indirect cost to refer to productivity gains or losses related to illness or death

- **Direct costs**
  - Health professionals' time
  - Supplies and equipment
  - Capital costs
  - Cost for treating side effects and complications
  - Costs of treating conditions during added years of life
- **Direct non-health care costs**
  - Child care costs
  - Home care services
  - Transportation
  - Special nutrition
  - Time cost
- **Indirect costs**
  - Intangible or psychic costs
  - Productivity gains or losses (income x days)

- **Marginal cost versus average cost**
  - **Average cost** measures total costs per unit,
  - **Marginal cost** is the additional cost of producing one more unit of service, it varies as volume changes.

No. of services	Total costs	Average costs	Marginal costs
10	3000	300	
30	5000	167	100
50	6000	120	50

No. of services	Total costs	Average costs	Marginal costs
10	3000	300 (3000/10)	
30	5000	167	100 (5000-3000)/ (30-10)
50	6000	120	50 (6000-5000)/ (50-30)

- **For a community (10,000 population) breast cancer screening program**
  - Old test, 1 dollar per person, detect 100 case
  - New test (old test plus another test) , 2 dollar per person, detect 110 case
  - What is the average cost per case detected in both situation?
  - What is the marginal cost for detection of one further case?

- **For a community (10,000 population) breast cancer screening program**
  - Old test, 1 dollar per person, detect 100 case
    New test (old test plus another test) , 2 dollar per person, detect 110 case
  - What is the average cost per case detected in both situation?

    (old: 1 x 10000/100=100); (new: 2 x 10000/110=182);
  - What is the marginal cost for detection of one further case?

    (20000 – 10000)/(110-100)=1000

- **Variable costs** is the additional costs incurred when service is expanded.
  - Drugs, …
- **Fixed costs** are those that are held at a constant level, independent of the level of production and the time frame of the analysis.
  - Durable medical equipment, property, plant, …

Measuring Outcomes

- Case detected (e.g. breast cancer)
- Life saved
- Life-years saved
- Quality-adjusted-life-years (QALYs) saved
- Intermediate outcomes
- Measure outcomes in money terms (in CBA)

Quality of Life

- Not every year of life has the same quality
- Alternative interventions may have different effects on quality of survived life
  - Renal dialysis vs renal transplantation toward renal failure

QALYs

- Suppose there is two regimen can be adopted for a particular disease

years	1	2	3	4	5
QALYs (regimen A)	0.6	0.5	0.3	0.2	0.1
QALYs (regimen B)	0.9	0.8	0.7	0.6	0.5

  - If compared by survival years, both 5 years.
  - If compared by QALYs, QALYs (A)=1.7, QALYs (B)=3.5, a significant difference

Connect Costs and Outcomes

---Basic types of economic evaluation

- Cost minimization analysis
- Cost-benefit analysis
- Cost-effectiveness analysis
- Cost-utility analysis

Cost Minimization

- Alternative choices have very similar outcomes, so to seek the choice which consume the least cost
  - Both test A and B can detect 100 case of breast cancer in 10, 000 population, but test B is twice expensive as test A, so it is reasonable to adopt the test which has the least cost

Cost-Benefit Analysis (CBA)

- CBA try to value the consequences in money terms, so as to make them commensurate with the costs.
- Generally it is very difficult to value health and life directly
  - Human Capital approach
  - Willingness-to-pay (WTP) method

WTP

- To estimate the value of health services by asking people how much they are willing to pay for these services
  - Suppose in a 100,000 population, each person is willing to pay $20 so that the mortality rate could decrease from 3/100000 to 1/100000, then the total amount of WTP is $2 millions, and the WTP per statistical life saved is $1million

Cost-Effectiveness Analysis (CEA)

- Measure consequences in the most appropriate natural or physical units (e.g. years of life gained, cases correctly diagnosed)
- Most frequently used

- Example of CEA

Programs	Cost	Effectiveness	C/E
A	2000	0.2	10000
B	8000	0.4	20000
C	18000	0.6	30000

  - Which one is the best?

Cost-Utility Analysis (CUA)

- When alternative treatments may be examined using multiple dimensions of health outcomes.
- Particularly useful for those health treatments that extend life only at the expense of side effects

Utility example:

twin brother

one is a drawer

one is a oral translator

one day they went to ski and made both their right arm broken.

Does they have same utility ?

CUA example

Regimen	QALYs	Cost	Total		Cost-utility	
			Population	QALYs	Cost	Ratio
1	9	3800	15	135 (9*15)	57000 (3800*15)	422 (57000/135)
2	8.6	2300	30	261	69000	264
3	8.3	1000	5	42	5000	119
4	7.5	5200	70	525	364000	693
5	3.8	300	50	190	15000	79

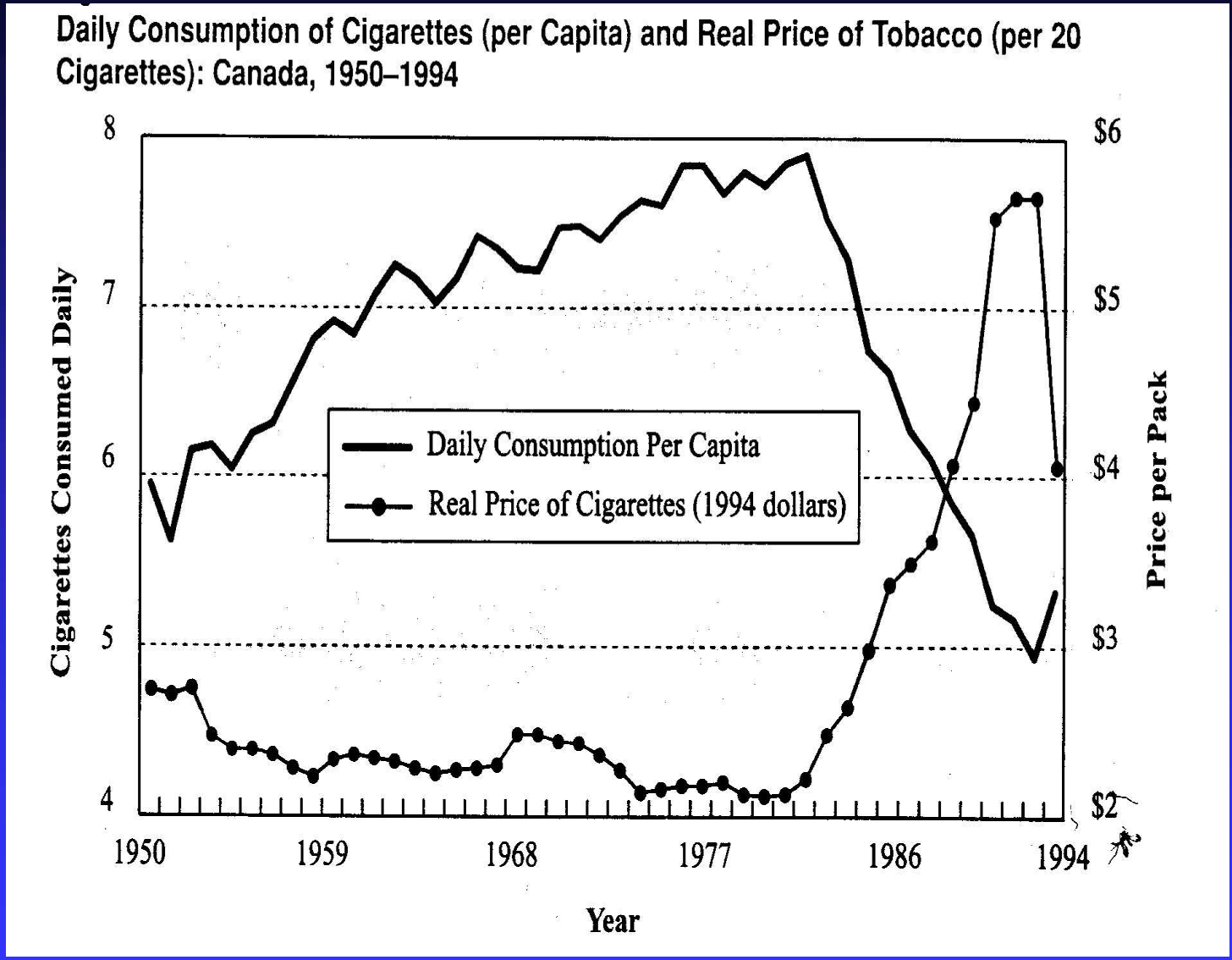
Adapted from Eddy（1996）

- From the individual patient's perspective, regimen 4 is better than 5, because it can obtain more QALYs (7.5 vs 3.8)
- From the social perspective, regimen 5 is better, because the same cost used for only one patient in regimen 4 can be used to treat 17 patients (5200/300), and the total QALYs obtained reach 65 (17*3.8), much higher than 7.5

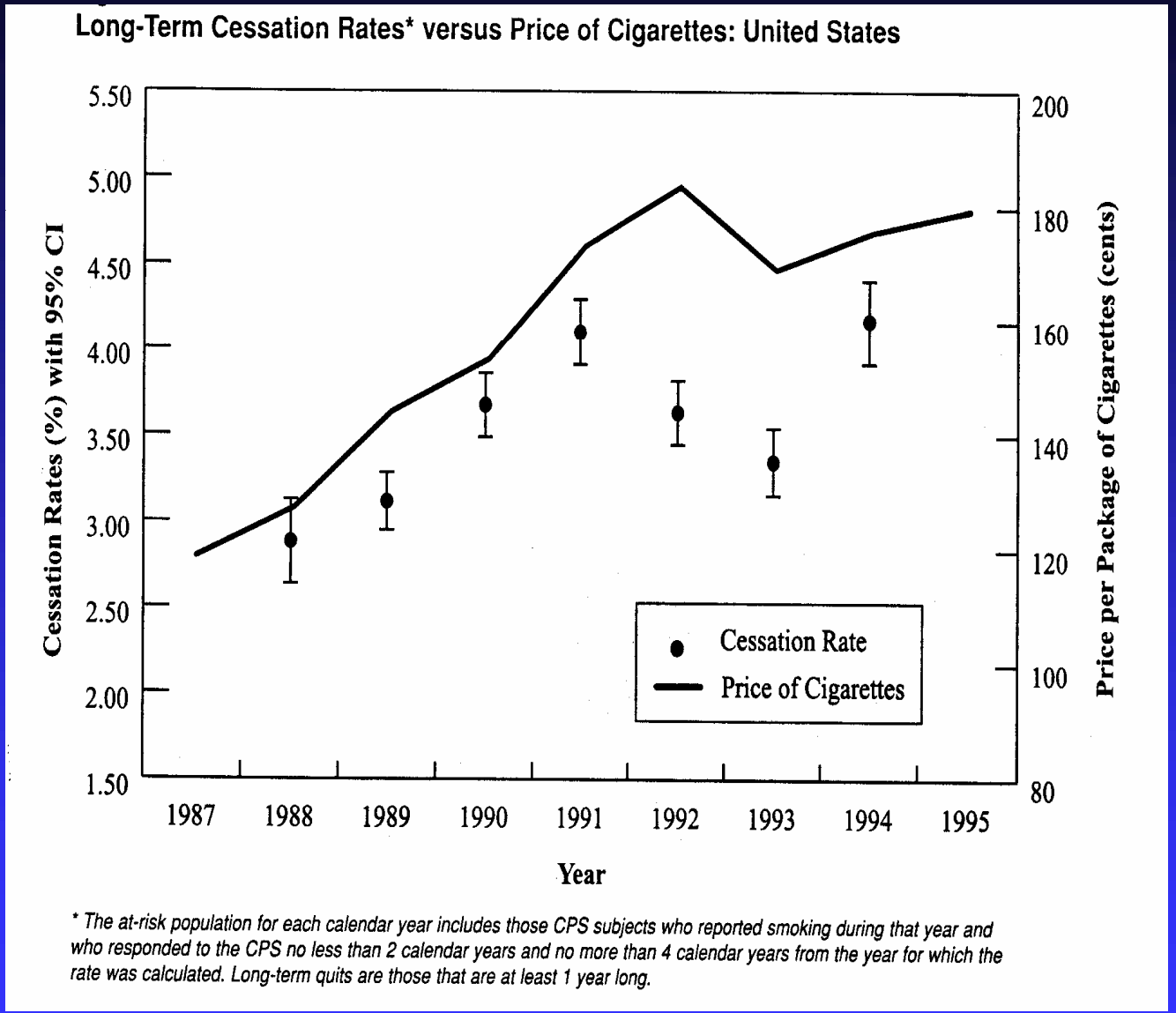
Health Economic Policy Implement:

FCTC article 6

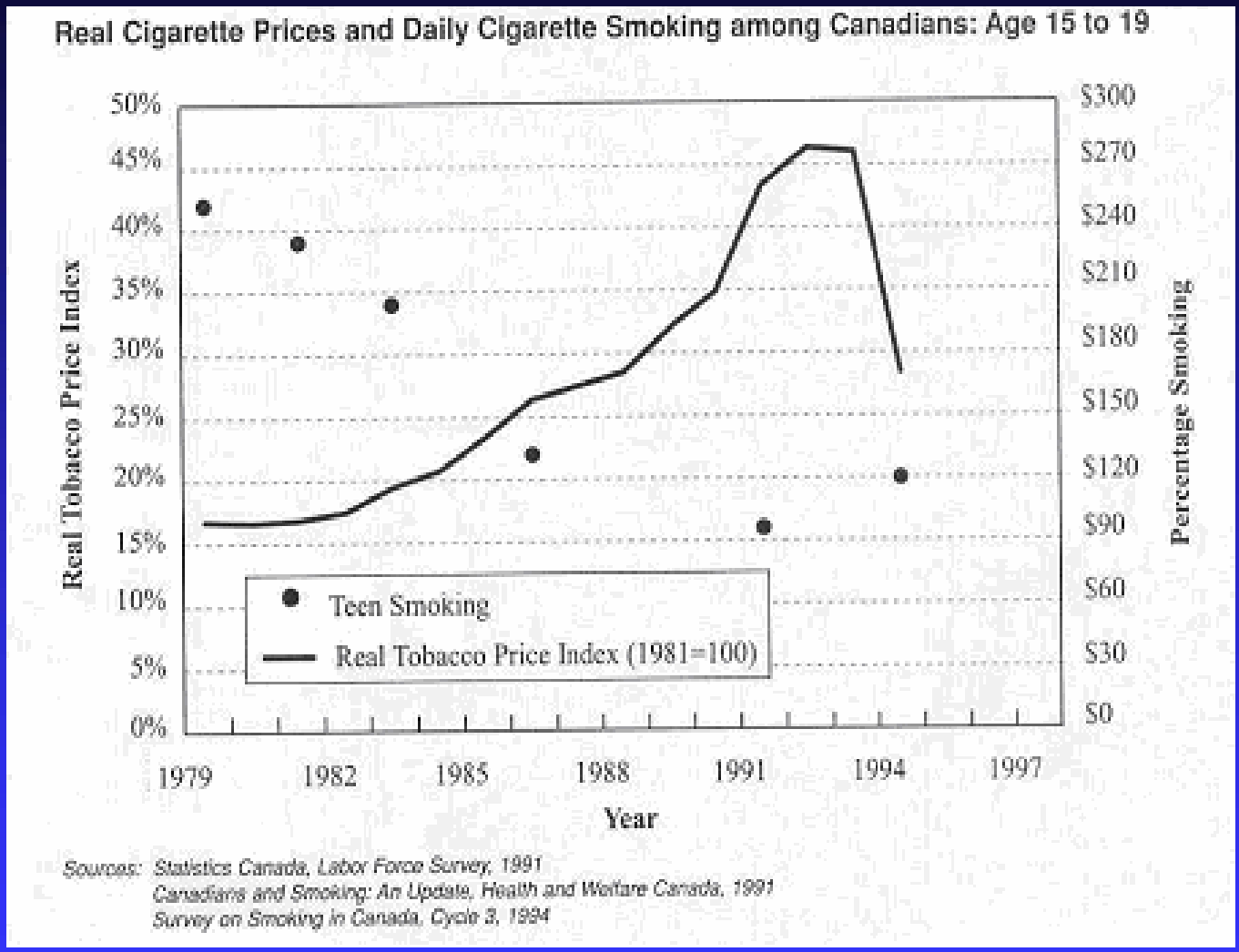
tobacco tax and price



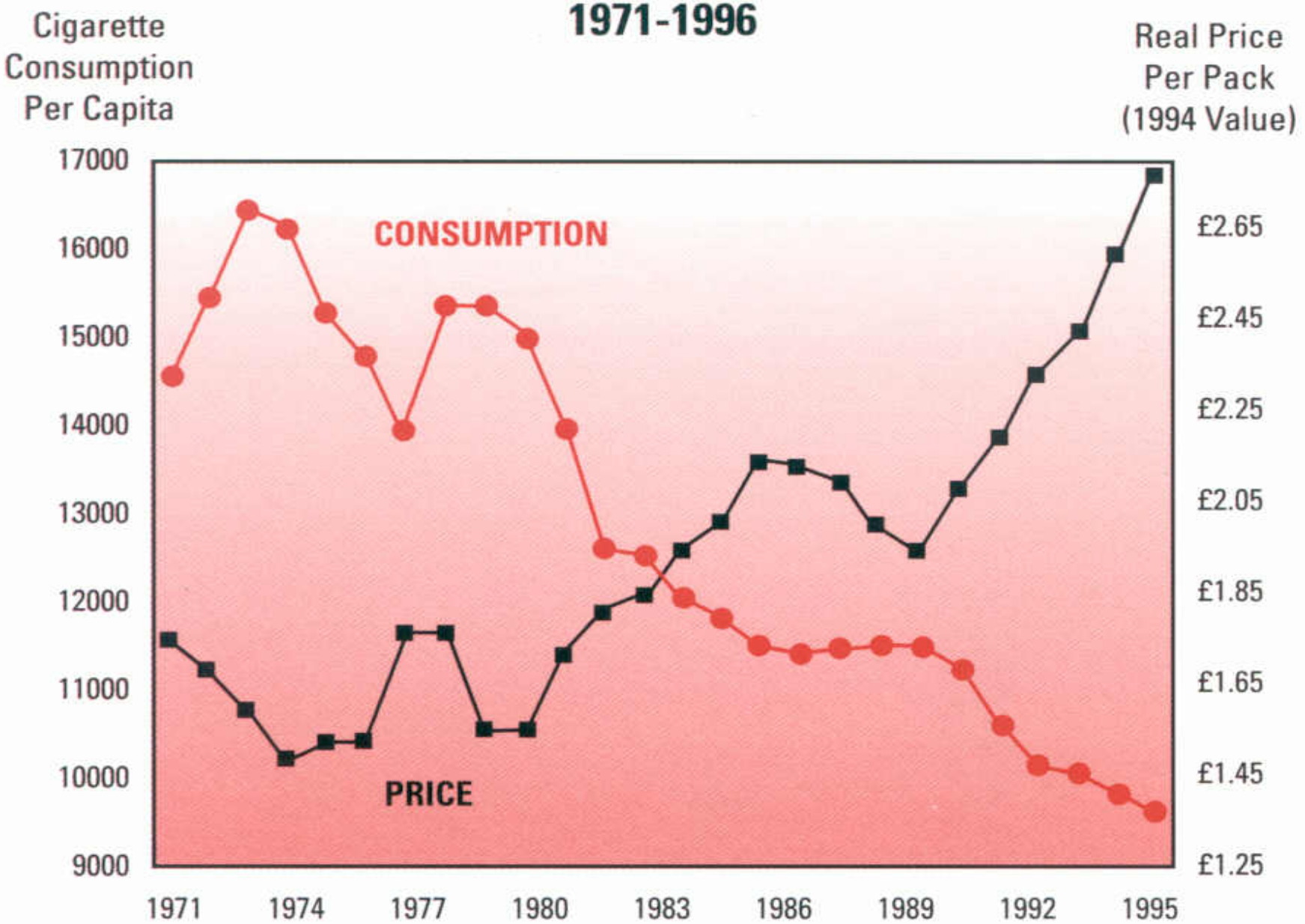
Source: Non-smokers' rights association, 1994.



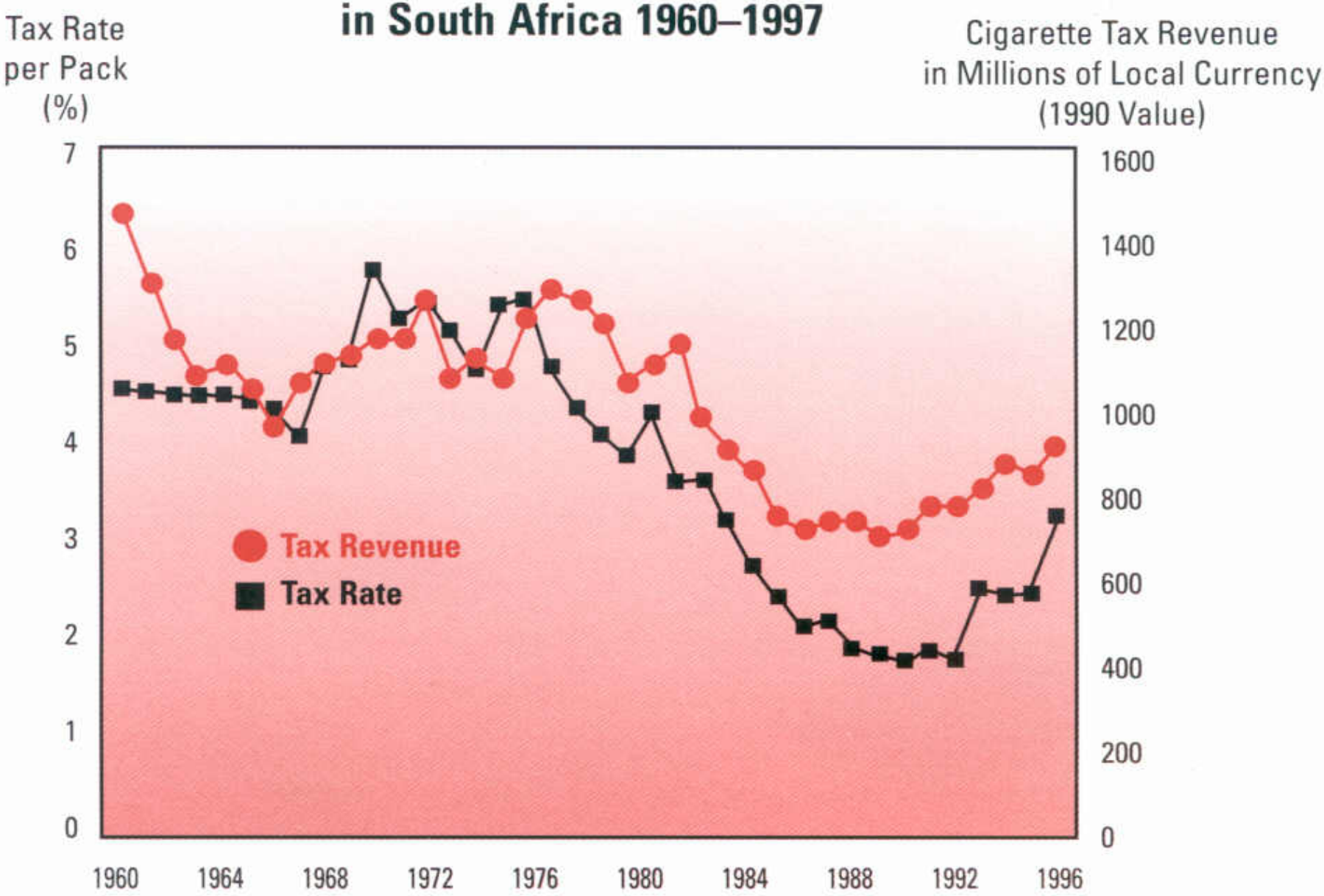
Source: Sweanor et al. 2000. NCI Monograph 12.


Real Cigarette Prices and Daily Cigarette Smoking among Canadians: Age 15 to 19
Real Tobacco Price Index
50%
45%
40%
35%
30%
25%
20%
15%
10%
5%
0%
$300
$270
$240
$210
$180
$150
$120
$90
$60
$30
$0
Percentage Smoking
Teen Smoking
Real Tobacco Price Index (1981=100)
1979
1982
1985
1988
1991
1994
1997
Year
Sources: Statistics Canada, Labor Force Survey, 1991
Canadians and Smoking: An Update, Health and Welfare Canada, 1991
Survey on Smoking in Canada, Cycle 3, 1994

Real Price and Consumption of Cigarettes in the UK 1971-1996



Real Cigarette Tax Rate and Cigarette Tax Revenue in South Africa 1960–1997



Revenue from TOB. & Excise Tax Rate (Nepal, 1985-1998)

Thanks!