This work is licensed under a Creative Commons Attribution-NonCommercial-ShareAlike License. Your use of this material constitutes acceptance of that license and the conditions of use of materials on this site.

Copyright 2006, The Johns Hopkins University and Hana Ross. All rights reserved. Use of these materials permitted only in accordance with license rights granted. Materials provided “AS IS”; no representations or warranties provided. User assumes all responsibility for use, and all liability related thereto, and must independently review all materials for accuracy and efficacy. May contain materials owned by others. User is responsible for obtaining permissions for use from third parties as needed.

JOHNS HOPKINS
BLOOMBERG
SCHOOL of PUBLIC HEALTH

Economics of Tobacco Control

Hana Ross, PhD
Research Economist, RTI International

Hana Ross, PhD

- PhD in Health Economics, University of Illinois, Chicago
- Research economist, RTI International
- Economics of tobacco control research projects in low and middle income countries, funded by World Bank, WHO, and European Commission
- Currently conducting research in Southeast Asia, Eastern and Central European region, former Soviet Republics

Image source: Institute for Global Tobacco Control

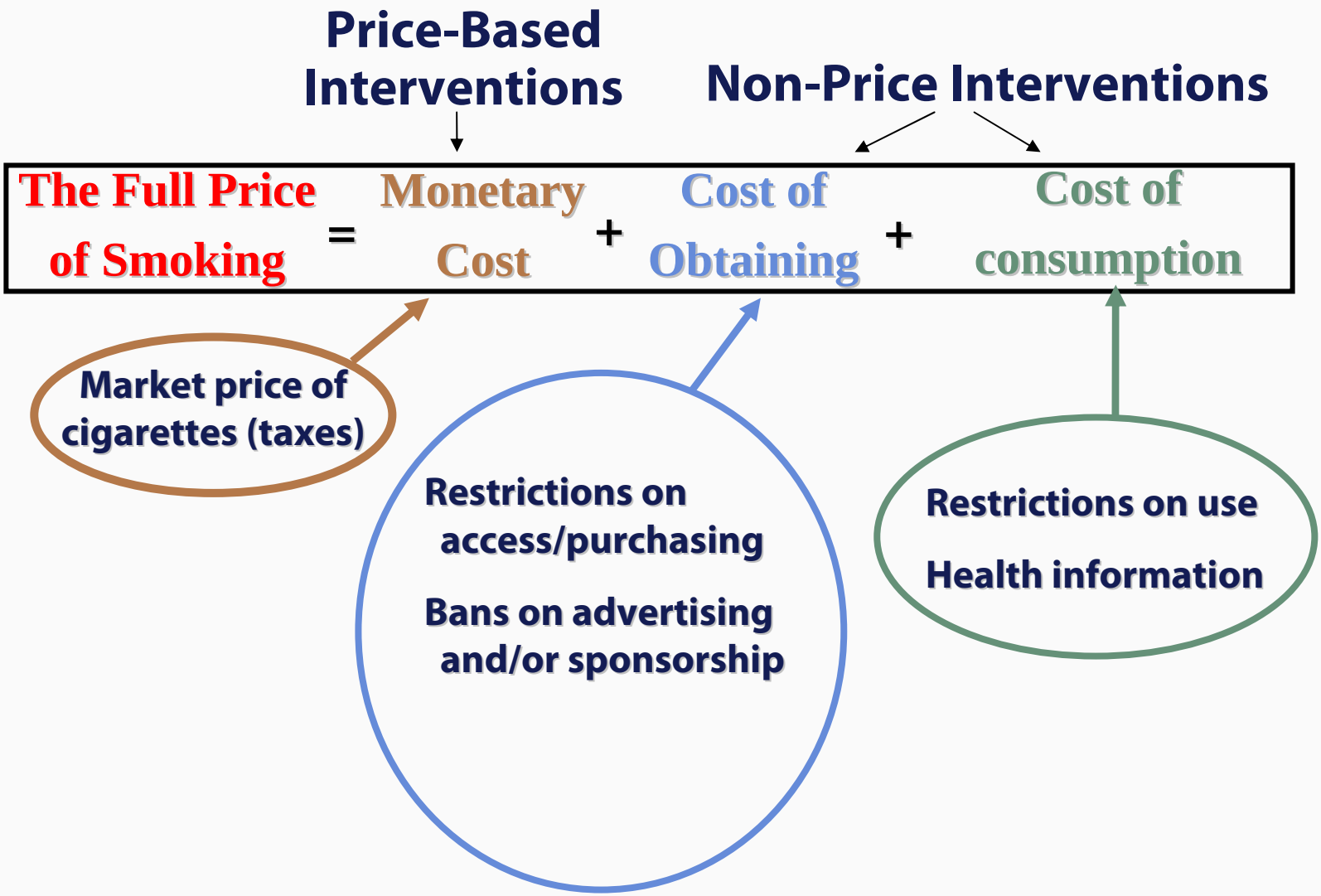
JOHNS HOPKINS
BLOOMBERG
SCHOOL of PUBLIC HEALTH

Section A

Interventions and Costs

- **Economic theory**—a person's behavior is motivated by maximizing utility (pleasure) with given resources (budget constraint)
  - S/he achieves it by paying identical price for each unit of pleasure
  - Change in behavior can be achieved by increasing the price or by reducing utility from the behavior
- **Applying to Tobacco Control (TC)**—increase price of cigarettes, make smoking less pleasurable (e.g. smoking bans, health information, etc.)

Full Price of Smoking



Government Interventions in Tobacco Market

- Economic rationale for government interventions in the tobacco market
  - There is a market failure
  - Externalities
    - Physical or financial costs imposed on non-smokers (health, lower labor productivity, and economic growth)
    - Inadequate information about the health risks of tobacco
    - Inadequate information about the risks of addiction
  - Internalities (costs smokers impose on themselves)

Demand-Side Interventions

- Changing economic **incentives** for smoking behavior (lowering the utility of smoking) by increasing the **full price** of smoking

Supply-Side Interventions

- Changing economic **incentives** for tobacco farmers and manufacturers by increasing cost of production and distribution

- Examples—limiting youth access to tobacco products, advertising restrictions, law enforcement to prevent smuggling

Topics in Economics of Tobacco Control

1. Cost of smoking

2. Design of TC measures (what works)

3. Effectiveness of TC measures (what is the cheapest way to do TC)

4. Assessment of the impact of TC on the economy (government revenue, poverty reduction, employment, trade balance, smuggling, company profits)

Costs of Tobacco Use

- Definition of the costs depends on the **entity** bearing the costs
  - The whole society
  - An individual—smoker or non-smoker
  - The government

- When counting costs it is important to compare state of the economy **with and without** tobacco

Costs (Society Perspective)

- Direct costs (out of pocket)
  - Health care costs (e.g. preventive care, outpatient, inpatient, transportation, etc.)
  - Fire costs, cleaning costs

- Indirect costs (opportunity costs)
  - Morbidity related (e.g., lost income, time of others)
  - Mortality (e.g., lost pension)

Source: Lightwood, J., Collins, D., Lapsley, H., Novotny, T.E. (2000). "Estimating the costs of tobacco use" in Jha, P., Chaloupka, F.J., Tobacco Control in Developing Countries. Edited Volume. Oxford: Oxford University Press: Section I, Chapter 4.

Example: Former Soviet Republic

- If adult male survival in **former Soviet Republic (FSR)** were that of Organisation for Economic Co-operation and Development (OECD) countries, annual growth rates over the last three decades would have been about 1.4% vs. 1%

- 1990 per capita **income**
  - Actual $2,700
  - With better male survival $3,000
  - This is **12% loss** in income, or cumulative loss for all FSR $140,000,000,000

Source: www.cmhealth.org/wg1.htm; Jamison, Dean T., Sandbu, Martin, and Wang, Jia (2002). Cross-Country Variation in Mortality Decline, 1962-87: The Role of Country-Specific Technical Progress. CMH Working Paper Series, Paper No. WG1: 4.

Costs (Individual Perspective)

- External costs (incurred by non-smokers)
  - Direct medical care (not paid for directly by smokers)
  - Reduced productivity
  - Fire losses
  - Lost income due to early mortality

- Internal costs (incurred by smokers and their families)
  - Direct medical care
  - Lost income due to morbidity and mortality
  - Fire losses
  - Opportunity cost of buying cigarettes

- Internal costs are more than 100 times larger than external costs

Costs Incurred by Employer

- Employee smoking break
- Higher absentee rate

Example: Opportunity Costs of Smoking

- Annual household tobacco spending in **Cambodia** is equivalent to these highly demanded products

US $69.44 million =

274,304 Tons of Rice

63,131 Motorcycles

27,778 Cars

27,778 Units of Big Wooden Houses in Rural Areas

Source: Samrech, Phauk, Ross, Hana, Hallen, Greg, Sisovanna, Sau (2004). "Tobacco and Poverty in Cambodia," a research report to ThaiHealth, presented at APACT session "Research Evidence for Tobacco Control Policies: Southeast Asia"

Costs (Government Perspective)

- Direct costs (out of pocket)
  - Depends on the extent of social services (e.g., health care subsidies, social safety net for the poor, subsidies for health care insurance and other insurance services)
  - Cost of fire, cleaning costs
- Indirect costs (opportunity costs)
  - Morbidity and mortality related (e.g., lost income tax)
- Revenue/savings
  - Tobacco taxes (but there are alternatives)
  - From tobacco production (corporate tax, profit)
  - Mortality related (saved pension benefits)

Example: Phillip Morris Study of the Czech Republic

- **Narrow view** of costs of smoking—government (budget) perspective
- All tobacco **taxes** counted **as benefits** (alternative tax base not considered)
- If taxes left out from the calculation, smoking **costs** the government **thirteen times more** than its savings (on pensions and housing for elderly)

Source: Swoger, K. (2001, June 27). Report says smoking has benefits. Prague Post.

- Economic theory provides a **framework**
  - Theory of demand assumes an individual **utility function** (but also rational behavior)
  - Utility from smoking = number of cigarettes, utility from other goods, and individual tastes
  - Utility maximization subject to **budget constraint** (price of cigarettes, income, prices of all other goods)

Questions of Interest

- Does **price/tax** affect tobacco consumption and to what extent (price/tax elasticities)?
- What **other public policies** can change smoking behavior?
- Can **advertising** encourage tobacco use?
- Does smoking depend on **personal income** (income elasticity)?
- Will **globalization**, trade liberalization, and/or privatization change the demand for tobacco products?

Analysis of Demand for Tobacco

- Data collection (consumption and its attributes, farming and manufacturing, TC regulations)
  - **Macro/micro-level** data have advantages and disadvantages
  - **Minimum information**—quantities, price, income
  - Other data of interest—price of other tobacco products, smuggling, health knowledge, advertising exposure, smoking restrictions, other TC measures, social-demographic data

Continued

Analysis of Demand for Tobacco

- Econometric **models** derived from **hypothesis** (tobacco is a normal good or an addictive substance)

- **Functional form** (linear, log forms, etc.)—based on assumptions about consumers' price responsiveness

Continued

Analysis of Demand for Tobacco

- Example of **conventional linear demand** (aggregate data, time series):
  - $Q_t = b_0 + b_1 P_t + b_2 Y_t + b_3 T_t + b_4 SR_t + b_5 D_m + \varepsilon_t$
- Q_t = per capita consumption of cigarettes per adult in year *t*
- P_t = weighted average real retail price per cigarette in year *t*
- Y_t = real personal disposable income per adult in year *t*
- T_t = time trend variable in year *t*
- SR_t = index of smoking restrictions in year *t*
- D_m = 0–1 indicator for the introduction of information campaign in year *m*

Continued

- Estimating methods

  1. Ordinary Least Square (OLS)—for continuous variables

  2. Probability distribution models (**Probit** or **Logit**) for dichotomous variables

Continued

- Test the model performance
  - Assumption of exogenoity
  - Does the model fit the data?
  - Stability of coefficients
  - Efficiency of estimates

Continued

Analysis of Demand for Tobacco

- Interpreting results

- Price elasticity
  - Percentage of change in demand (both quitting and fewer cigarettes among smokers) resulting from a one percent change in price)
  - $\%\Delta Q / \%\Delta P = b_1 \times P_t / Q_t$ (linear demand function)

- Expected values
  - –0.14 to –1.23 (higher in low-income and middle-income countries)

JOHNS HOPKINS
BLOOMBERG
SCHOOL of PUBLIC HEALTH

Section B

Taxation Reduces Demand

Taxation Is the Most Effective Measure

- Higher taxes induce **quitting**, **reduce** consumption, and **prevent** starting
- A 10% price increase reduces demand by . . .
  - 4% in high-income countries
  - 8% in low or middle-income countries
  - About half of the effect is on amount and half on initiation
  - **Long-run** effects may be greater
- **Young** people and **the poor** are the most price responsive

Source: Chaloupka, F.J., Hu, T., Warner, K.E., Jacobs, R. and Yurekli, A. (2000). "The taxation of tobacco products." In Jha, P., Chaloupka, F.J., Tobacco Control in Developing Countries. Edited Volume. Oxford: Oxford University Press: Section I, Chapter 10.

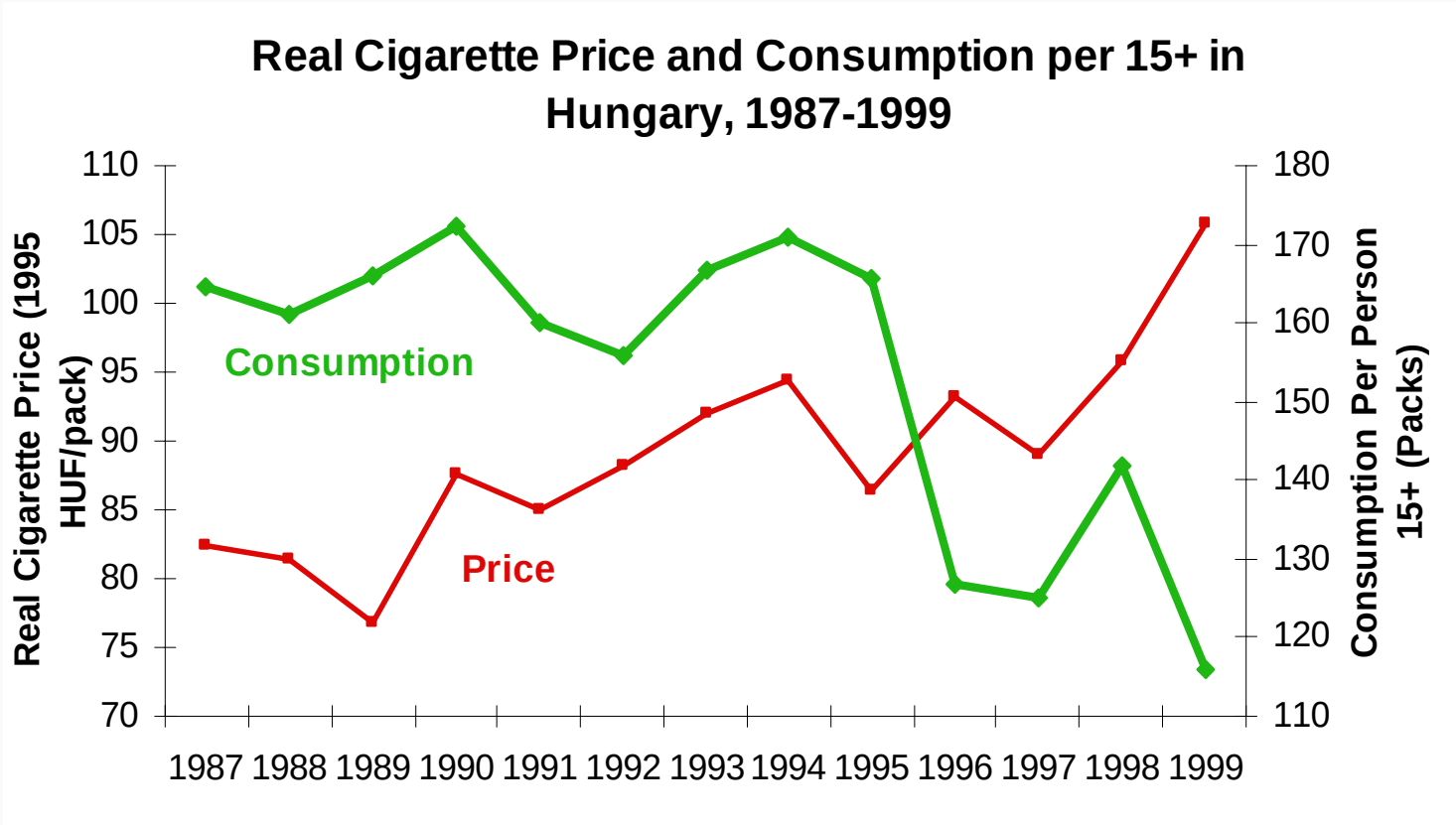
Tax Example

- Population price elasticity = - 0.8; tax increase causes cigarette prices to double (e.g. from $4 to $8)
  - There is 100% increase in price
  - Formula for price elasticity
  - Price elasticity = % quantity / % price
  - - 0.8 = % quantity / 100
  - % quantity = - 0.8 * 100 = - 80%

- **Result**—doubling the price leads to 80% decline in consumption

Price Elasticity Evidence from Hungary

- As tax increases, consumption decreases

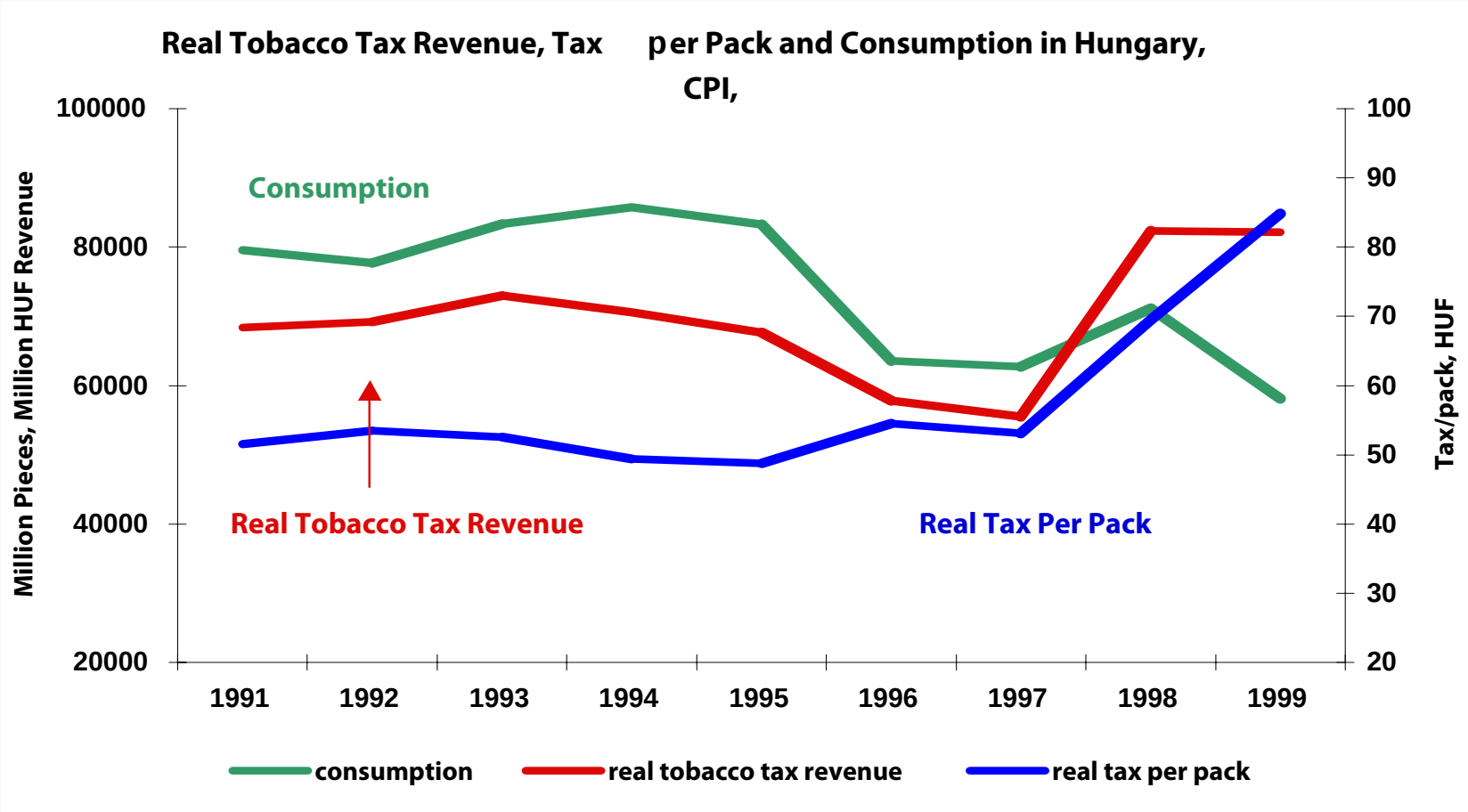


Source: Economics of Tobacco in Hungary. In Country Economics of Tobacco Briefs. World Bank and USDA (2000). http://www1.worldbank.org/tobacco/countrybrief.asp accessed 3/1/06

- Impact of a tax increase on **tax revenue**
  - Current tax revenue = tax base (number of cigarette packs) * tax rate (tax per pack)
  - Percentage increase in price = proposed tax increase/current price*100
  - Change in demand after tax increase = current demand (tax base) * price elasticity * percentage increase in price/100
  - New tax revenue = new demand * new tax rate

Evidence from Hungary

- Since 1997 the tax rate has increased and so has total revenue (in real terms)



Source: Economics of Tobacco in Hungary. In Country Economics of Tobacco Briefs. World Bank and USDA (2000). http://www1.worldbank.org/tobacco/countrybrief.asp accessed 3/1/06

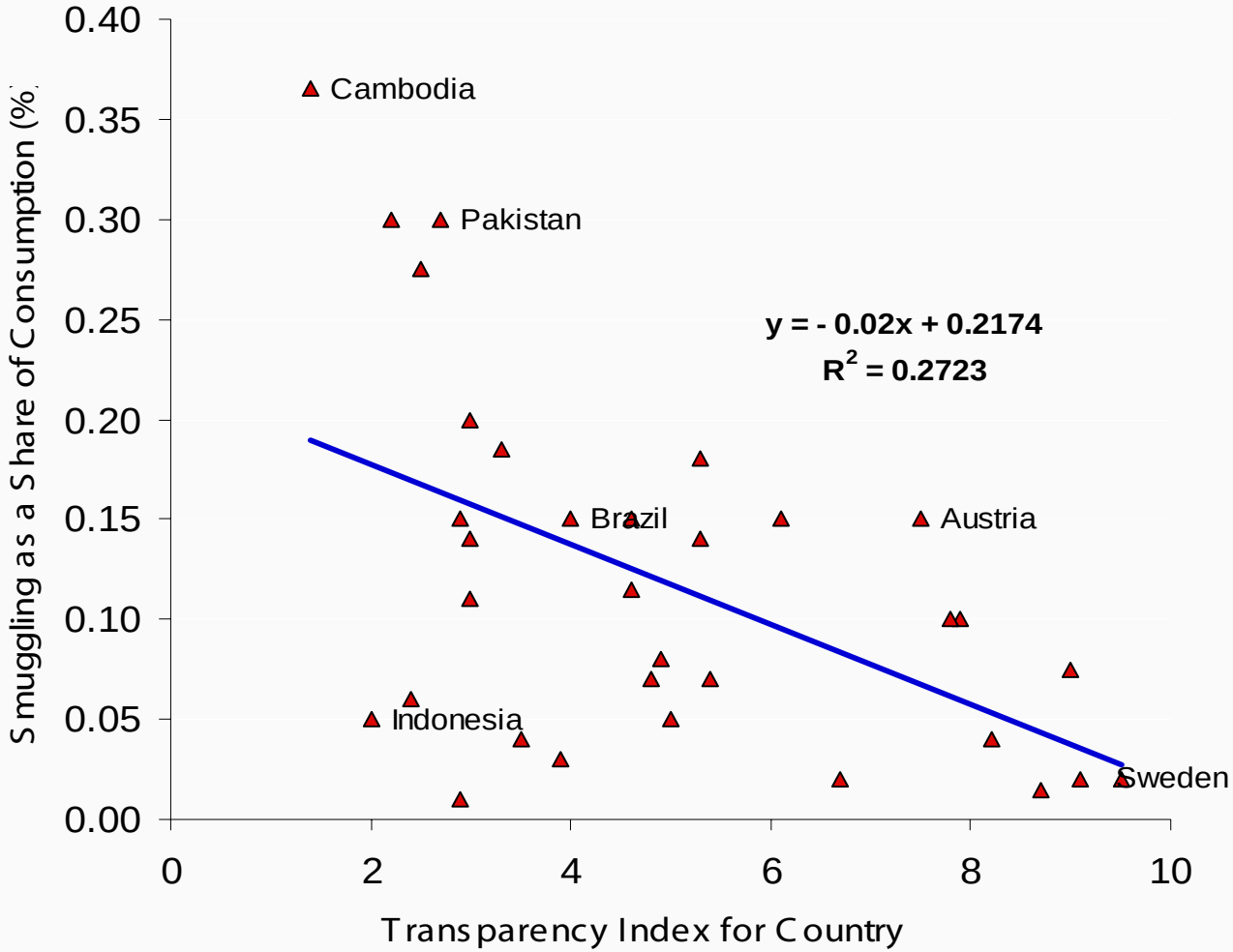
Smuggling Undermines the Impact of Taxes

- **Motivation** for smuggling—tax avoidance and price differentials
- Industry has incentives to smuggle to achieve higher sale/profit
- Best **estimate**—6 to 8.5% of total consumption
  - Perceived level of corruption more important than cigarette prices
- Tax increase will lead to **revenue increase, even in the event of increased smuggling**

Source: Merriman, D., Yurekli, A., and Chaloupka, F.J. (2000). "How big is the worldwide cigarette smuggling problem?" In Jha, P., Chaloupka, F.J. Tobacco Control in Developing Countries. Edited Volume. Oxford: Oxford University Press: Section I, Chapter 15.

Smuggling as a Function of Transparency Index

- Tobacco smuggling tends to rise in line with the degree of corruption



Source: Merriman, D., Yurekli, A., and Chaloupka, F.J. (2000). "How big is the worldwide cigarette smuggling problem?" In Jha, P., Chaloupka, F.J. Tobacco Control in Developing Countries. Edited Volume. Oxford: Oxford University Press: Section I, Chapter 15.

Measures to Address Smuggling

- Countries need not make a choice between higher cigarette tax revenues and lower cigarette consumption; **higher tax** rates can achieve both
- Measures
  - Focus on large container smuggling
  - Prominent local language warnings and tax stamps
  - Increase penalties
  - Licensing and tracking of containers
  - Increase export duties or bonds
  - Multilateral tax increases

Source: Joossens, L., Chaloupka, F. J., Merriman, D., Yurekli, A. (2000). "Issues in the smuggling of tobacco products" in Jha, P., Chaloupka, F.J. Tobacco Control in Developing Countries. Edited Volume. Oxford: Oxford University Press: Section I, Chapter 16.

Impact on the Poor

- Tax increases can be **progressive**
  - greatest sensitivity to price in lowest income populations
- Tobacco taxes should be considered in context of overall tax and spending system
  - Revenues generated from tax can be used to support programs targeting the poor **(earmarking)**
- **Health benefits** of tobacco control are progressive
  - Tobacco accounts for about half of the health gap between the rich and the poor

Source: Chaloupka, F.J., Hu, T., Warner, K.E., Jacobs, R., and Yurekli, A (2000). "The taxation of tobacco products." In Jha, P., Chaloupka, F.J. Tobacco Control in Developing Countries. Edited Volume. Oxford: Oxford University Press: Section I, Chapter 10;

Non-Price TC Measures

- Information dissemination
- Ban on advertising/promotion
- Restrictions on smoking in public and work places
- Access to cessation services and nicotine replacement therapy (NRT)
- Individually less effective compared to a tax increase
  - Combining a tax increase with other TC measures (**comprehensive programs**) is a cost effective public health method

Source: Joossens, L., Chaloupka, F. J., Merriman, D., Yurekli, A. (2000). "Issues in the smuggling of tobacco products" in Jha, P., Chaloupka, F.J. Tobacco Control in Developing Countries. Edited Volume. Oxford: Oxford University Press: Section I, Chapter 16.

Global Trade and TC

- Removing trade barriers reduces import tariffs, increase competition (more advertising), motivates specialization, which leads to **lower prices** and **higher** tobacco **consumption**

- Solution
  - Adopt special trade rules for tobacco, because of its externalities (harms public health) and/or
  - Adopt stronger TC policies

Source: Douglas, W., Bettcher, Derek, Yach, G., Guindon, Emmanuel (2000). Global trade and health: key linkages and future challenges. Bulletin of the World Health Organization, 78 (4)

Role of (WTO) in Tobacco Trade

- Trade agreements usually do not adequately protect tobacco control measures from trade-based challenges

- There is a **precedent** in other international agreements for provision to restrict trade in harmful products such as tobacco

- World Trade Organization (WTO) needs to consider the impact of tobacco trade on public health when negotiating trade agreements

Tobacco Importance to the Economy

- A significant economic **presence** does not imply significant economic **dependence**:
  - Tobacco taxes generate only a few percent of total revenues
  - Employment generated by tobacco is under 1%
- Spending on tobacco is rarely important to an economy—money not spent on tobacco will be spent on **other goods** and services instead, thereby creating a comparable number of jobs
- Real costs = **costs of transition** to alternative products

Source: Warner, Kenneth E. The economics of tobacco: myths and realities. Tobacco Control: 9:78–89