

Surplus Appropriation from R&D and Health Care Technology Assessment Procedures

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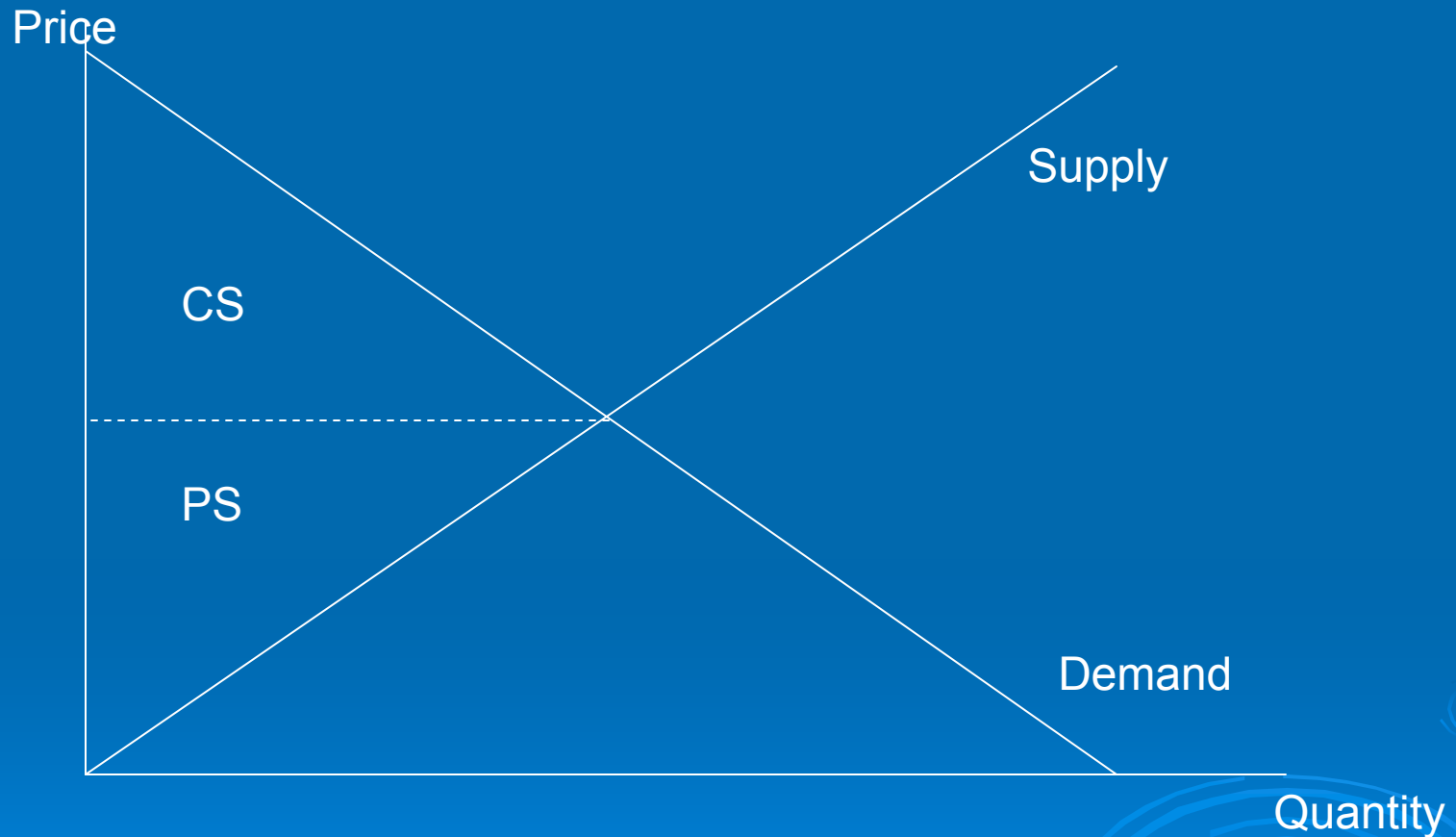
Motivation

- New technology is a driving force behind growth in healthcare spending
- How do we value and manage these new technologies?
- Desirability of CE Analysis in a Market or Non-Market (Government) Context?

Bottom Lines

- Need to account for dynamic incentives when assessing & adopting technology
- CEA induces static efficiency but not dynamic
 - Both dynamic efficiency and health will be maximized when *CE minimized*
- Dynamic R&D Incentives Are Modest
 - New HIV technologies: producer surplus 5% of social surplus
 - Harvard Registry technologies: median 13%
- Broader implications for using CEA to further lower R&D incentives

Surplus of New Technologies



$$\text{Social Surplus } SS = CS + PS$$

CE Analysis

- Quality Adjusted Price Measure
 - Ex: Cost per QUALY
- Aims to Maximize Consumer Surplus
- Consistent with Static Efficiency
- Efficiency gains when prices brought closer to costs

Dynamic Efficiency and CE Analysis

- CE technologies ~ High Consumer Surplus ~ Low Producer Surplus
- Maximizing expected social surplus results in $CS = 0$ and $PS = SS$ i.e. CE is minimized!
- Higher CE \rightarrow larger under-investment in R&D
- Price Discrimination \rightarrow CE minimized, Dynamic Efficiency and Health is Maximized
- Why CEA harmful for public technology
Adoption: Price Control in Disguise

Alternative Models of R&D—Is Full Appropriation Always Optimal?

- Too much R&D due to competitive R&D investments, i.e. patent racing
- Publicly subsidized R&D lowers optimal levels of private R&D and appropriation
- Effects of insurance and moral hazard on optimal appropriation
- Consumer Based R&D and Pigouvian pricing

Estimating Surplus Appropriation for HIV/AIDS R&D

➤ Consumer Surplus

- Incidence and Per-Capita Valuation by Year

➤ Producer Surplus

- Sales less variable costs as estimated by long-run generic prices

Gross Consumer Surplus of HIV/AIDS Drugs

- The total value of life g (i.e. the gross consumer surplus) induced by new drug consumption is:

$$g = \sum_{t=1980}^{2000} \beta^{t-1980} n_t \cdot g_t$$

where g_t is the value of increased survival for an individual in cohort t (relative to the 1979 baseline) and n_t is the incidence of HIV.

Gross Consumer Surplus of HIV/AIDS Drugs

- Infra-marginal value of survival gains
 - (Becker, Philipson, and Soares, AER 2006)

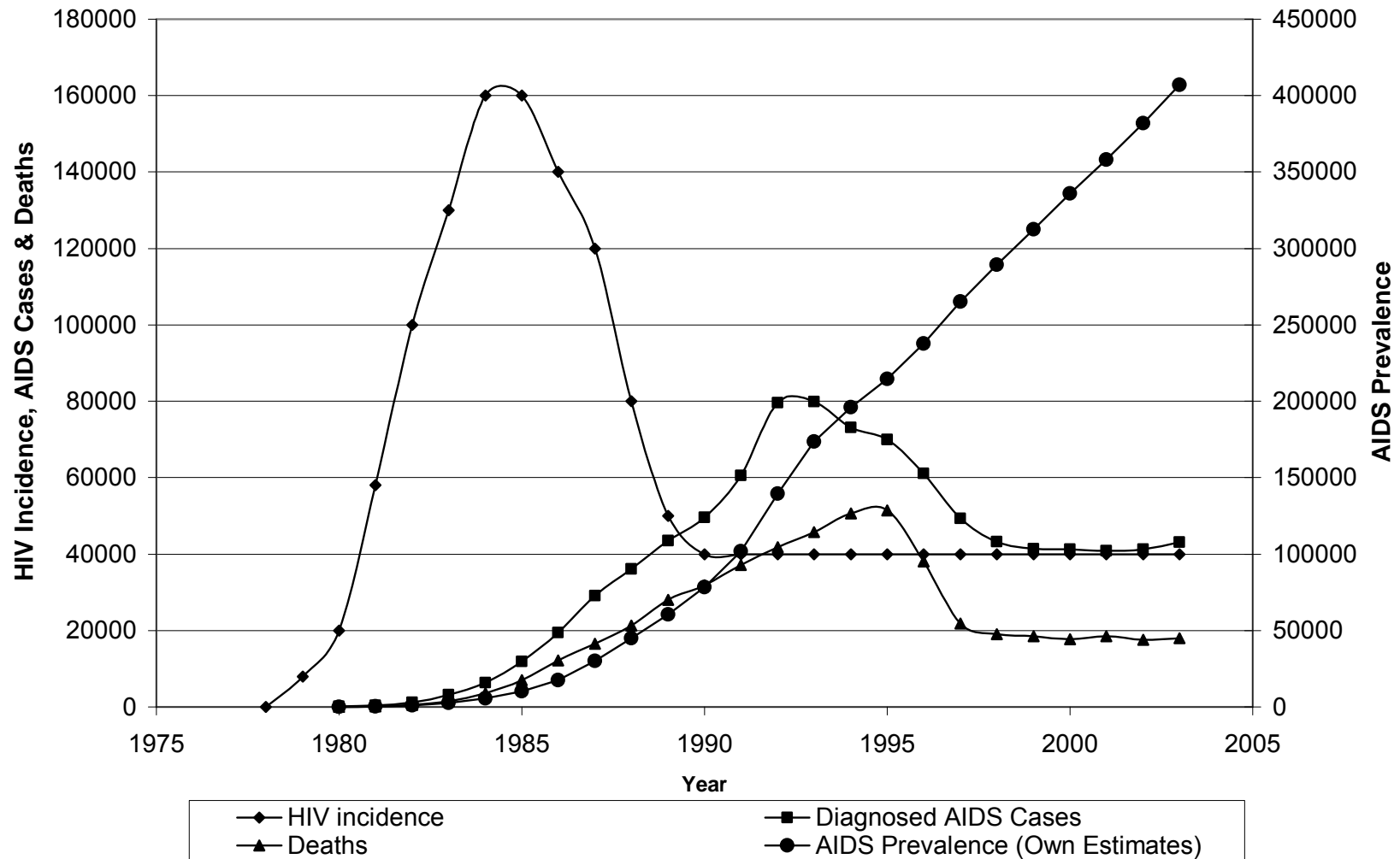
$$V[y_t + e_t, S_o(d)] = V[e_t, S_t(d)]$$

- Lifetime value of gain in survival:

$$g_t = \sum_{d=0}^{\infty} \beta^d \cdot S_o(d) \cdot e_t$$

Time-Series of HIV/AIDS

Figure 1: \hat{E} estimates of HIV Incidence, AIDS Incidence & Prevalence, & Deaths from AIDS



Survival from HIV

Figure 3: Survival from HIV by Year of Infection

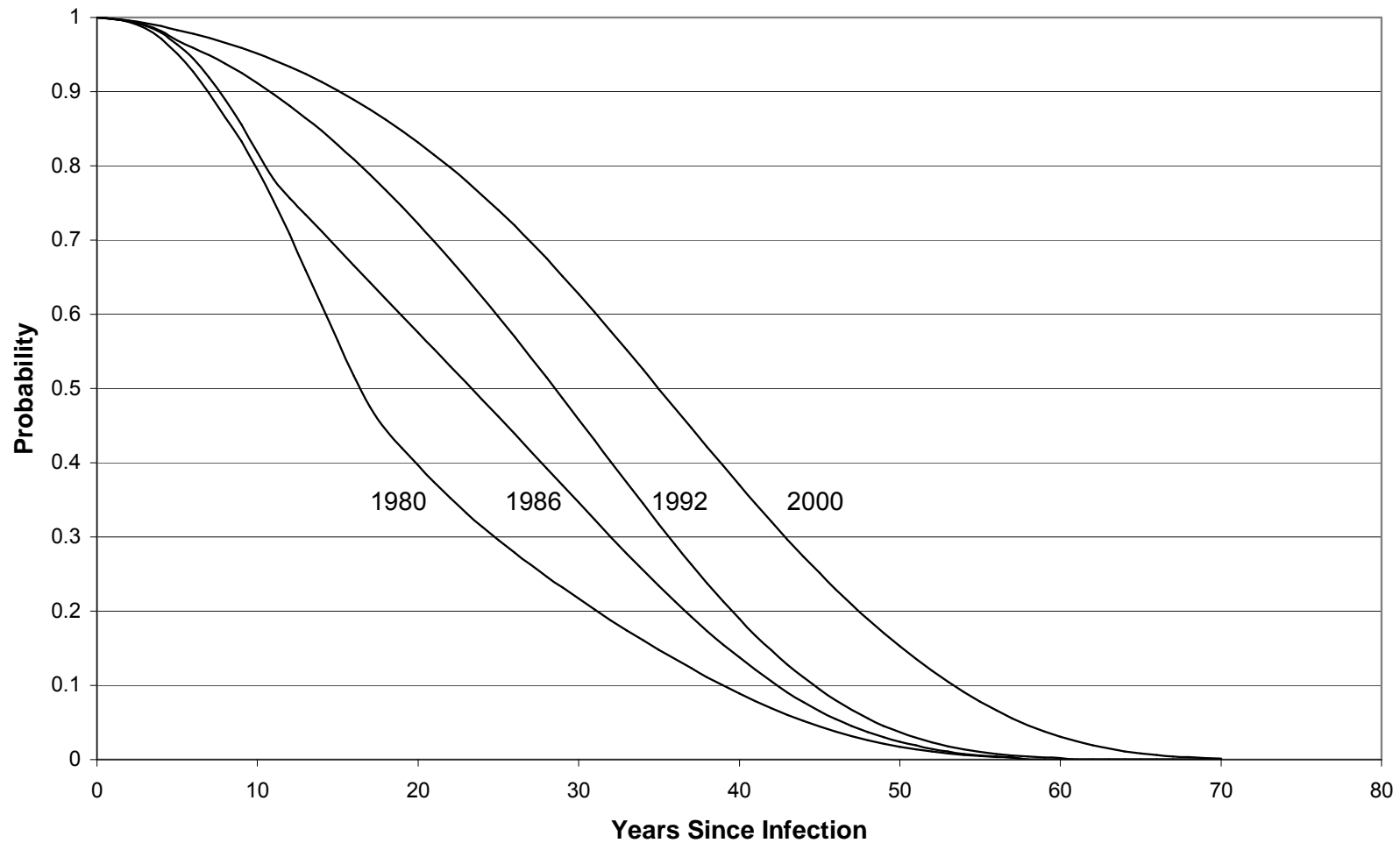


Table 1: Value of Gains in Survival for HIV Infected Individuals, Selected Years

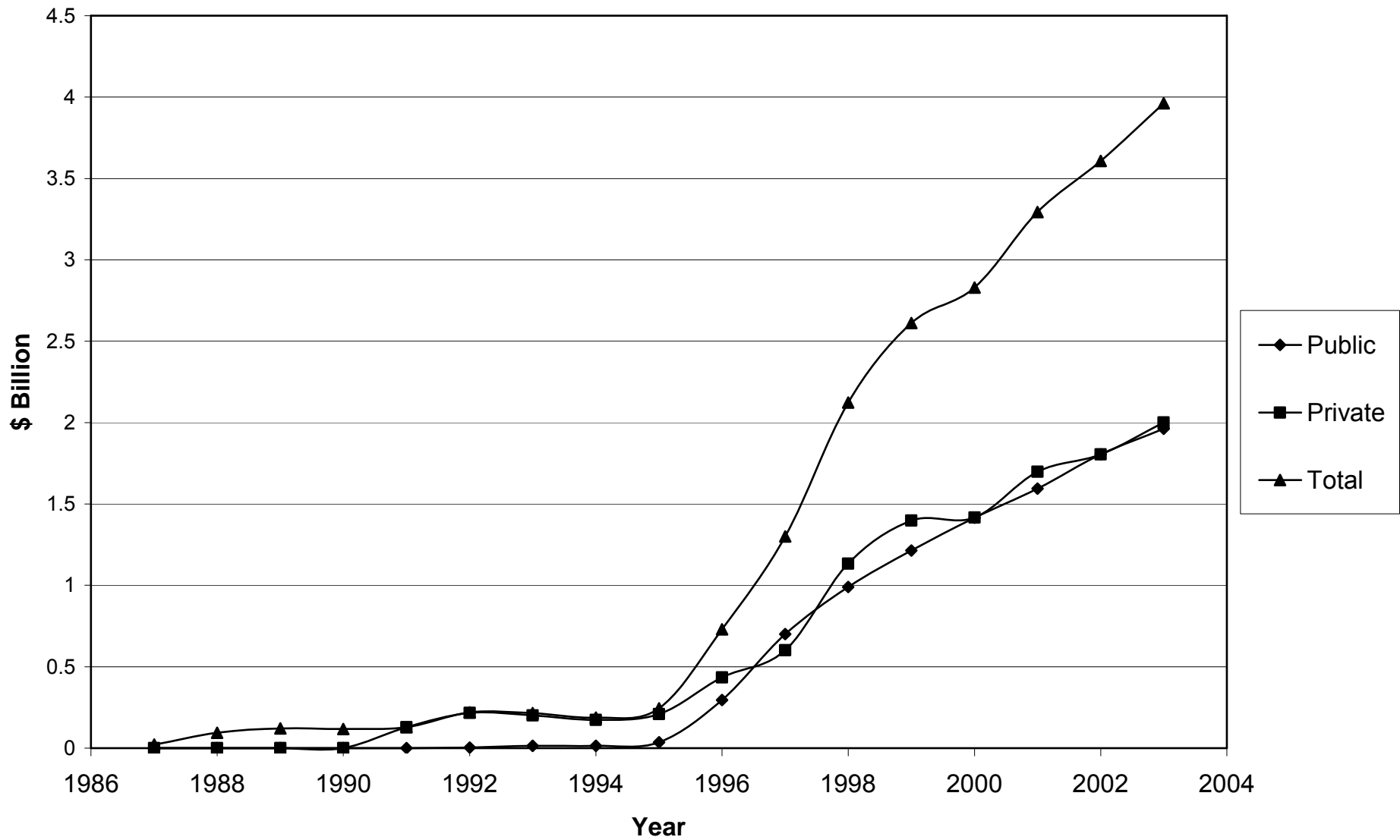
Year of HIV Infection	HIV Incidence	Value of Survival Gains (\$)	
		Individual (\$)	Aggregate (\$ Billion)
1980	20,000	17,655	0.35
1984	160,000	116,156	18.59
1988	80,000	250,284	20.02
1992	40,000	383,328	15.33
1996	40,000	696,951	27.88
2000	40,000	740,515	29.62
Total Discounted Value (Year 2000 \$ Billion)			398

All figures are discounted to 1980 and are in year 2000 dollars.

Producer Surplus from HIV/AIDS Drugs

- Lifetime producer surplus = Discounted sum of profits
- We estimate annual profits using annual sales data from IMS. Profits are assumed to equal 85% of sales
- Assuming future profits equal year 2000 profits, we estimate lifetime variable costs of \$11.2 billion and lifetime profits of \$62.9 billion

Figure 4: National Spending on HIV/AIDS Drugs



Producer vs Consumer Surplus

- We estimate social surplus to be nearly \$1.38 trillion (\$1.4 trillion gross benefit - \$15 billion in variable costs)
- Consumer surplus is \$1.33 trillion (\$1.4 trillion - \$74 billion in spending)
- Producer surplus is \$63 billion, or 5% of social surplus

CE and Appropriation

- Average mark-up and CE identify *observed* appropriation generally:

$$\frac{PS}{SS} = \frac{m-1}{m \cdot CE - 1}$$

- CE ~13 and $m(q) = 6.7 \rightarrow$ Approp = 7%
- Does this make sense?
 - Annual HIV drug cost \$9,751 per person \rightarrow profit of \$8,300. VOLY of 100K implies Obs App ~ 8%

