Developing technologies that we can't afford: can value based pricing help?

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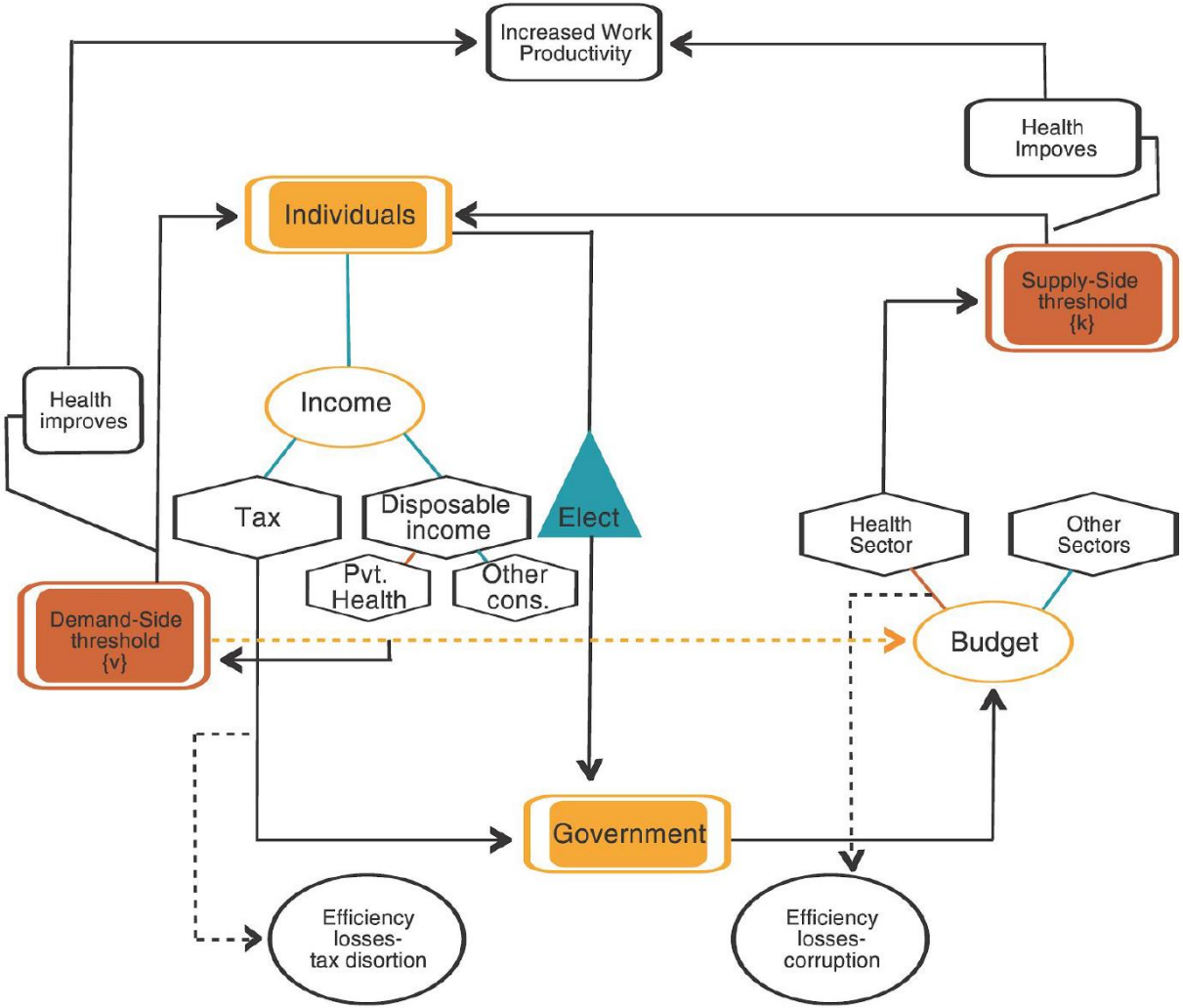
Overview

- Cost Effectiveness Threshold
- Value Based Pricing
- A novel conceptual framework
- Consumer Threshold Curve
- Producer Threshold Curve
- Policy Implications: Value Based Pricing
- Policy Implications: Health System Budgets and Innovation

Cost Effectiveness Threshold

- Two models of the Cost Effectiveness Threshold
  - Demand Side (Willingness to Pay for Health)
  - Supply Side (Shadow price of the budget constraint).



Relationship between Demand and Supply Side Cost Effectiveness Thresholds

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Value Based Pricing

- Naïve Value Based Pricing (VBP)sets price at a level where the ICER = Cost Effectiveness Threshold
  - Value Based Pricing has been operating in Sweden since 2002.
  - VBP proposed for UK in 2007 report from Office of Fair Trading
  - Adopted as UK Policy Objective in 2010
  - Abandoned as a UK Policy Objective in 2014
  - Proposed for the new Canadian Pharmaceutical Pricing framework (PMPRB) in 2017.
- Policy discussions in UK and now Canada focused on the implications for innovation and patient access.
  - There is no comprehensive theoretical framework to unpick these issues.

A novel conceptual framework

A New Conceptual Model of the Cost-Effectiveness Threshold

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Introduction

The cost-effectiveness ‘threshold’ (λ)

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- Common challenge faced by single-payer health care systems around the world is determining **which new health technologies to fund**
- Many health care systems use **health technology assessment (HTA)** to inform these decisions, and an important component of most HTA processes is a consideration of **which technologies are ‘cost-effective’**
- Involves a comparison of the **incremental cost-effectiveness ratio (ICER)** of each technology to a **cost-effectiveness ‘threshold’ (λ)**

‘Supply-side’ and ‘demand-side’ approaches

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- The past decade has seen **numerous advancements** in the theoretical and empirical literature regarding **how λ should be specified**
- Two conceptually different approaches: **‘supply-side’** and **‘demand-side’**
- Recent papers have provided **extensive reviews** of these approaches (Vallejo-Torres et al. 2016; Thokala et al. 2018)
- A **supply-side approach** assumes λ should reflect the **opportunity cost of adopting new technologies** (displacement of other health care services)
- A **demand-side approach** assumes λ should reflect **society’s willingness to pay for a unit of ‘benefit’**, typically a quality-adjusted life year (QALY)

Limitations of conventional approaches

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- In practice, funding decisions involve a number of **complex considerations**, *not all of which are taken into account by conventional approaches*
- Funding might **displace health care services** that provide ‘benefit’ to other patients - *not accounted for in a demand-side approach*
- Implications for the **supply of new technologies**: if λ is low, manufacturers may be unable to supply new technologies at a profitable price; if λ is high, manufacturers may make large profits but the opportunity cost is also large
- Specifying λ might result in **strategic pricing behaviour** from manufacturers (‘pricing to the threshold’), with implications for patients and manufacturers

Purpose of this paper

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- **The purpose of this paper is to propose a new conceptual model of the cost-effectiveness threshold that addresses these limitations**
- Incorporates considerations from conventional supply-side and demand-side approaches, including **opportunity cost** and **willingness-to-pay**
- Considers **costs incurred by manufacturers** in developing technologies and the **incentive for manufacturers to strategically price up to λ**
- Allows for considerations of **‘consumer surplus’** and **‘producer surplus’**, so decision makers may consider **how λ impacts upon the distribution of surplus between consumers (patients) and producers (manufacturers)**

Assumptions

Assumptions

1. There is a **publicly funded health care system** with a **constrained budget**
2. There is an accepted measure of **‘benefit’** that patients derive from health care
3. New technologies are **costly** to produce, and manufacturers will **not supply at a loss**
4. A **single threshold**, λ, is **publicly specified** by a health care system decision maker, with **new technologies adopted only if the ICER is less than λ**
5. Manufacturers of new technologies are **protected from price competition** (e.g. through the **patent system**), allowing for **super-normal profits**
6. Each adopted new technology is **strategically priced** such that the **ICER is equal to λ**
7. There is a **broad, continuous distribution of ‘reserve ICERs’**
8. Each new technology is **independent** and **developed by a different manufacturer**

Consumer perspective

Consumer perspective

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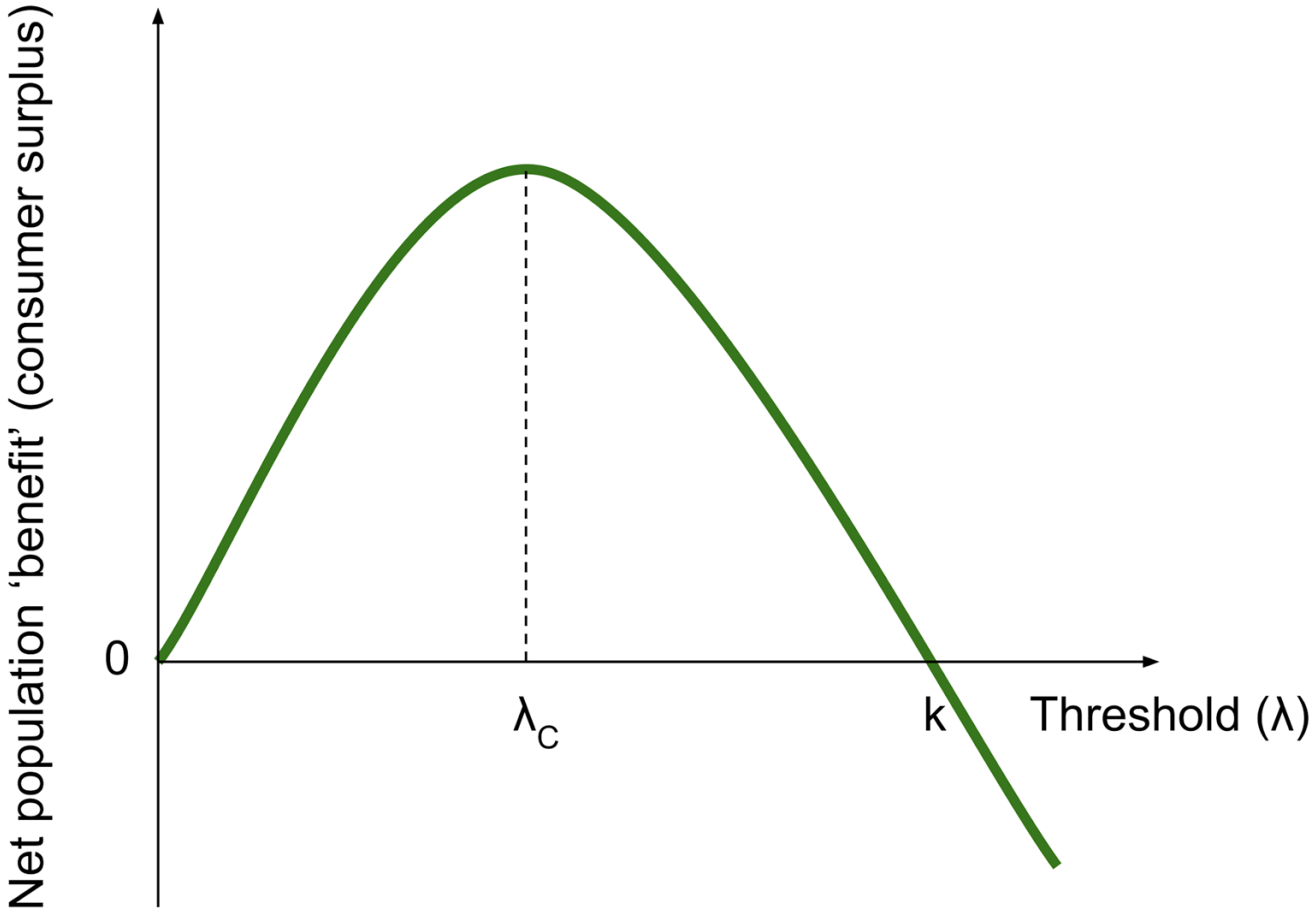
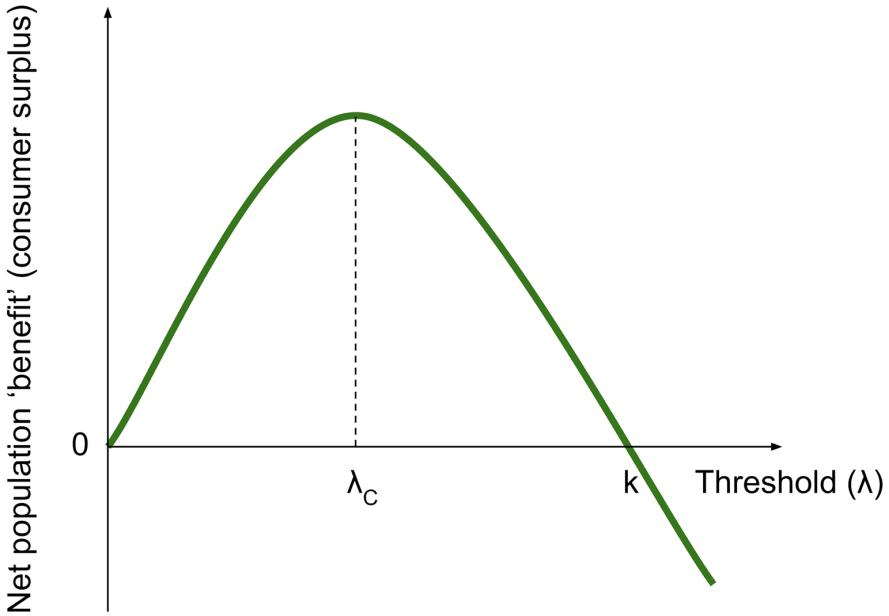
- The ‘consumer’ perspective is of **patients** within the health care system
- The outcome of interest is the **net population ‘benefit’**, which reflects the ‘benefit’ gained by patients who receive new technologies *net* of the ‘benefit’ forgone by patients who bear the opportunity cost
- **Net population ‘benefit’** represents the **consumer surplus** from the adoption of new technologies


Net population 'benefit' (consumer surplus)
0
λ_C
k
Threshold (λ)

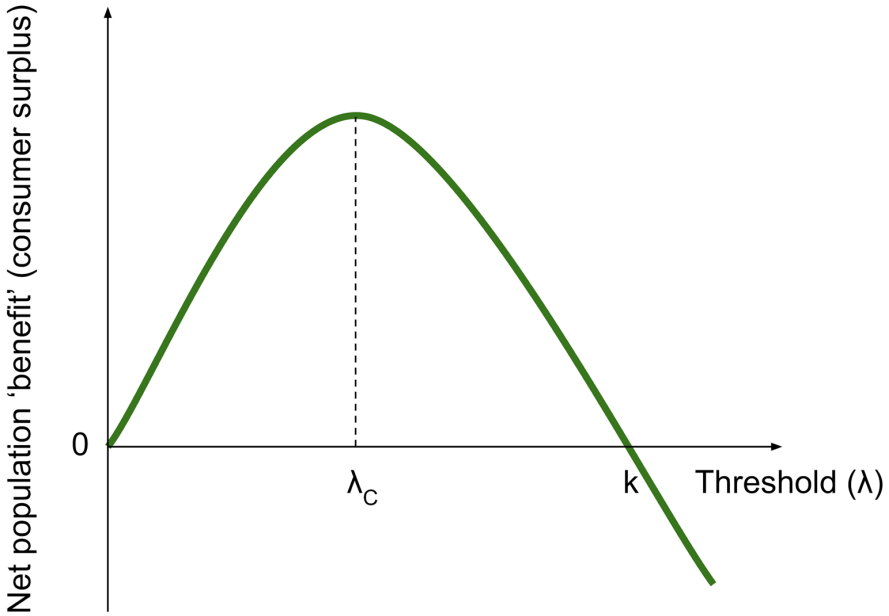
The first ‘anchor point’: λ = 0

No new technologies are adopted because the distribution of ‘reserve ICERs’ lies entirely above λ. Since no ‘benefit’ is provided by new technologies, but also no ‘benefit’ is foregone by other patients, net population ‘benefit’ is zero.



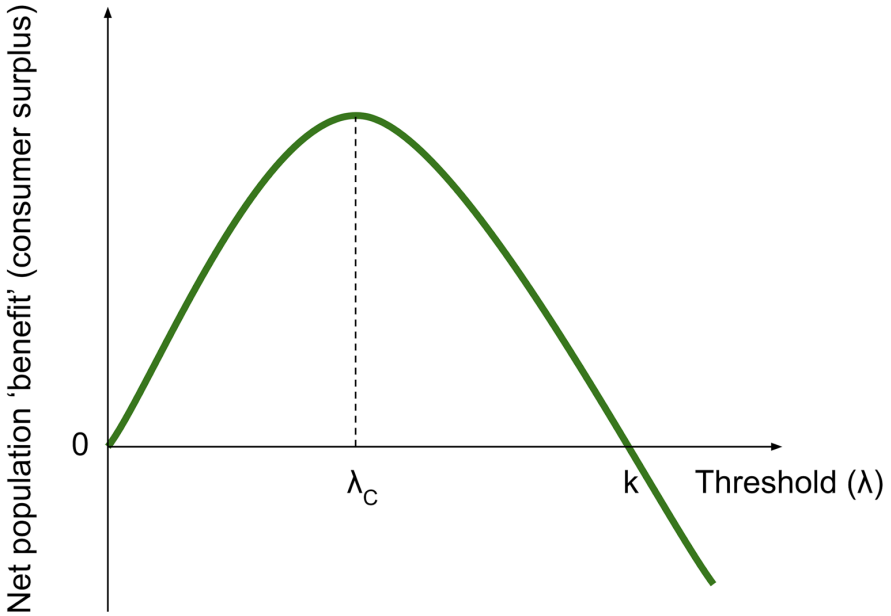
The second ‘anchor point’: λ = k

Some new technologies are adopted since they have a ‘reserve ICER' below λ. Manufacturers are protected from price competition and strategically price up to λ. Since technologies with an ICER of k displace one unit of ‘benefit’ for every unit of ‘benefit’ provided, net population ‘benefit’ is zero.



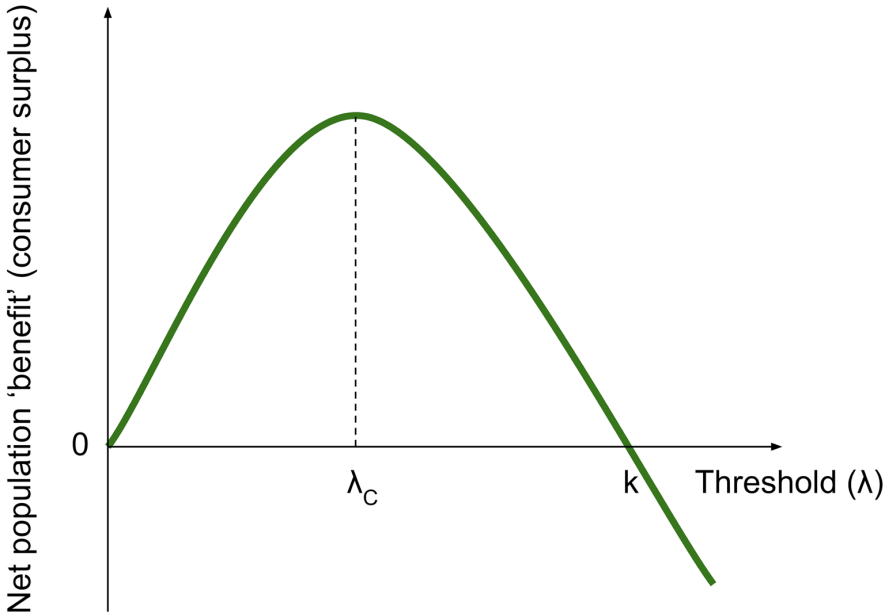
Increasing λ: additional supply of new technologies

New technologies with a 'reserve ICER' between λ1 and λ2 are now supplied. Each is strategically priced so that its ICER equals λ2. If λ2<k, the 'benefit' provided by each of these new technologies exceeds the 'benefit' forgone through displacement, increasing net population 'benefit'.



Increasing λ: strategic pricing of new technologies

Manufacturers of technologies with 'reserve ICERs' below λ1, which were adopted prior to the marginal increase in λ, now strategically raise prices until each ICER equals λ2.
This increases the 'benefit' forgone, diminishing net population 'benefit'.



Producer perspective

Producer perspective

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- The ‘producer’ perspective is of the **manufacturers of new technologies supplied to the health care system**
- The outcome of interest is the **profit arising to these manufacturers**
- The **profit arising to manufacturers that supply new technologies to the health care system** represents the **producer surplus** from the adoption of new technologies

Manufacturer profit

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- Manufacturer profit is determined by the **costs** of producing new technologies and the **revenues** arising from supplying the health care system
- Each manufacturer is assumed to be **unwilling to supply at a loss**, such that there is a **minimum 'reserve price'** (and hence **'reserve ICER'**) at which it will **supply the new technology** to the health care system
- If λ exceeds a manufacturer's 'reserve ICER', the new technology is supplied and **strategically priced** so that the **ICER equals λ -** this higher pricing is sustainable because **manufacturers are protected from competition**
    - In this case, it follows that the manufacturer will make a **positive profit**

Manufacturer profit

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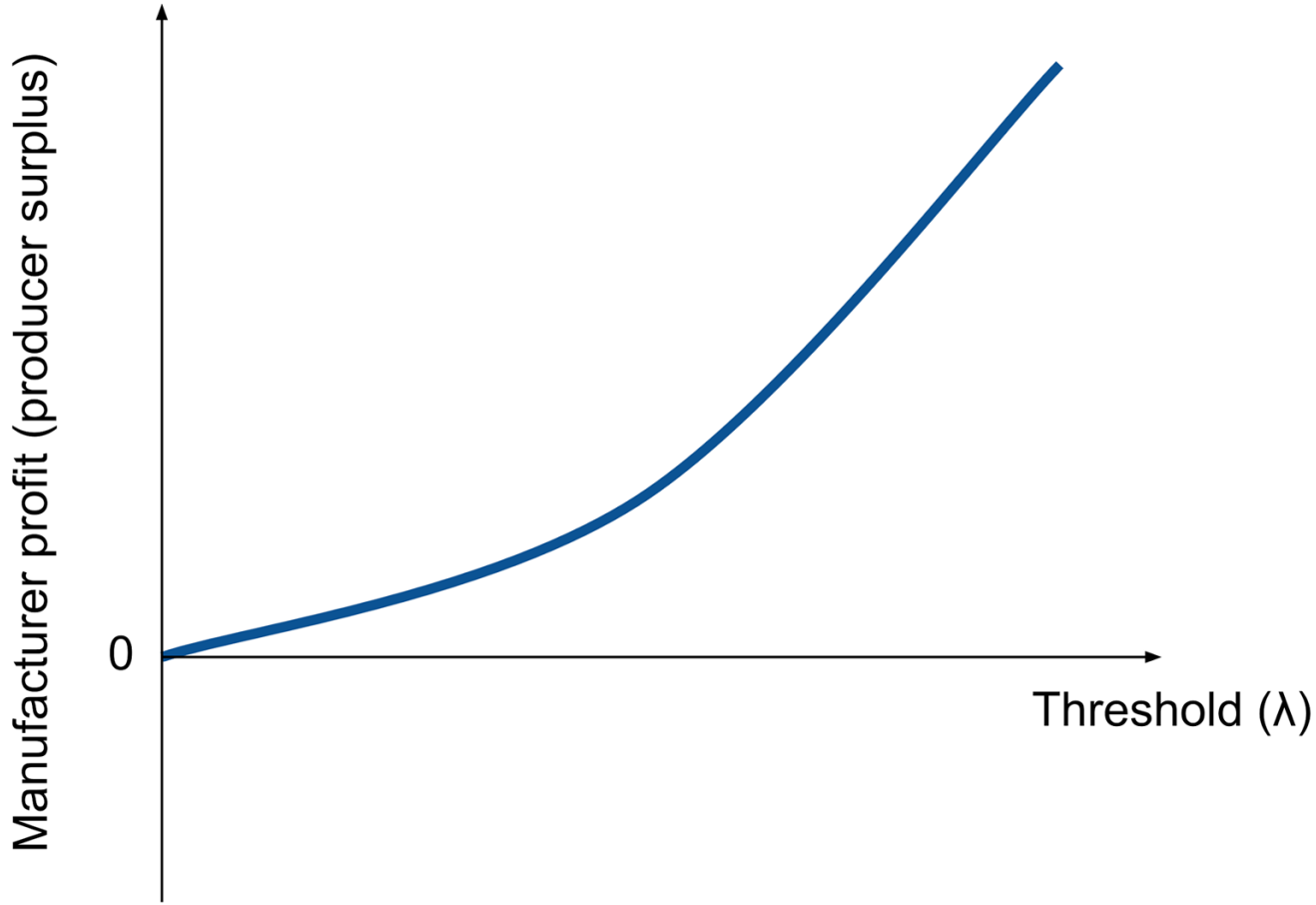
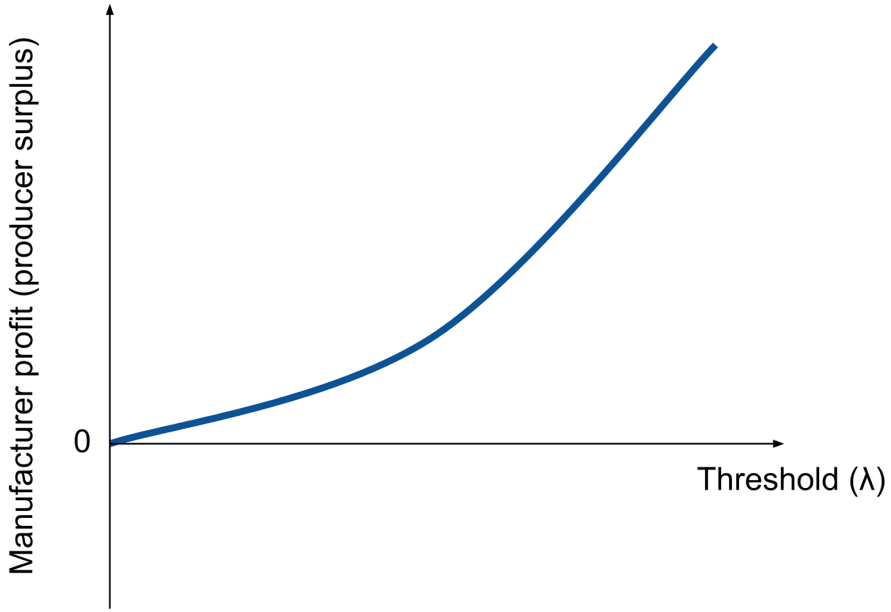
- If **λ is exactly equal to the reserve ICER** for a new technology, the manufacturer will **supply** the technology; however, the resulting revenue will only just cover the manufacturer's costs, so **there will be no profit** (or loss)
- If a manufacturer develops a new technology with a **'reserve ICER" above λ**, then **the technology will not be adopted by the health care system**
  - In this case, **the manufacturer is not considered a 'supplier' of new technologies to the health care system** (since no technology is supplied)
  - The profits and losses of non-suppliers are **not considered** within this model


Manufacturer profit (producer surplus)
0
Threshold (λ)

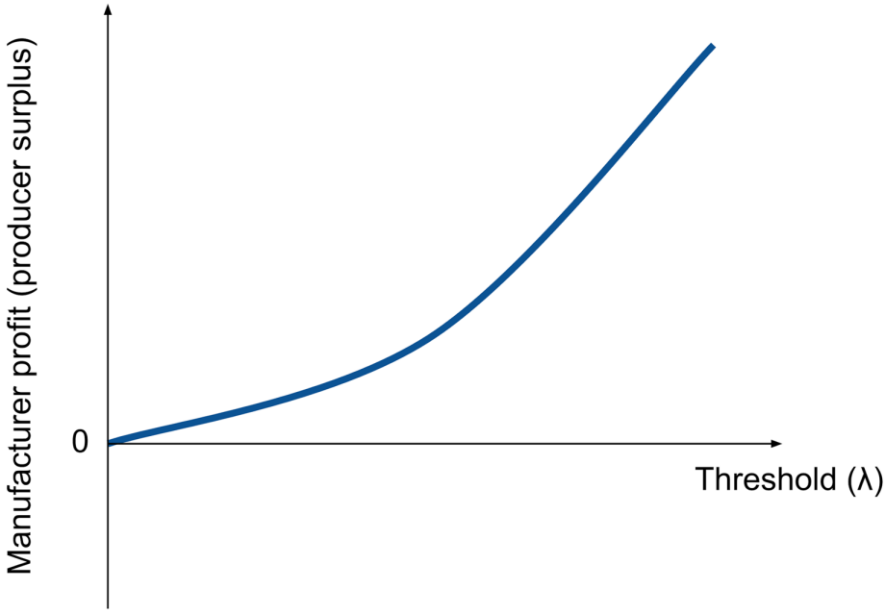
The ‘anchor point’: λ = 0

Manufacturer profit is zero because the ‘reserve ICER’ is not met for any new technology. It follows that no new technologies are supplied to the health care system, so no profit is made.



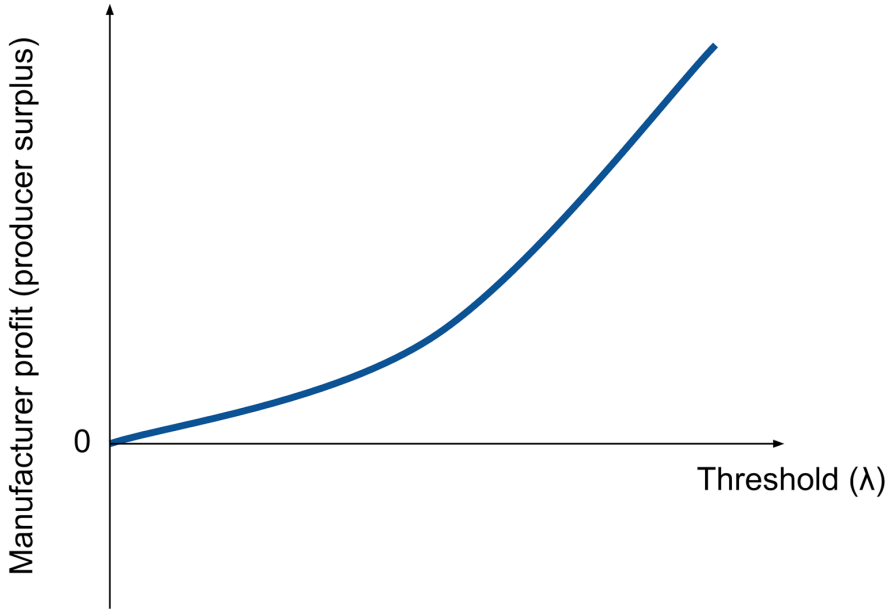
Increasing λ: additional supply of new technologies

New technologies with a ‘reserve ICER’ between λ1 and λ2 are now supplied to the health care system. Each of these new technologies is strategically priced above its ‘reserve price’ (such that the ICER equals λ), resulting in positive profits for their manufacturers.



Increasing λ: strategic pricing of new technologies

Manufacturers of new technologies with 'reserve ICERs' below λ1 now strategically raise prices until each ICER equals λ2. These new technologies were already profitable, but are now priced even higher, resulting in additional profit for manufacturers.



Combining the consumer and producer perspectives

Converting into a common metric

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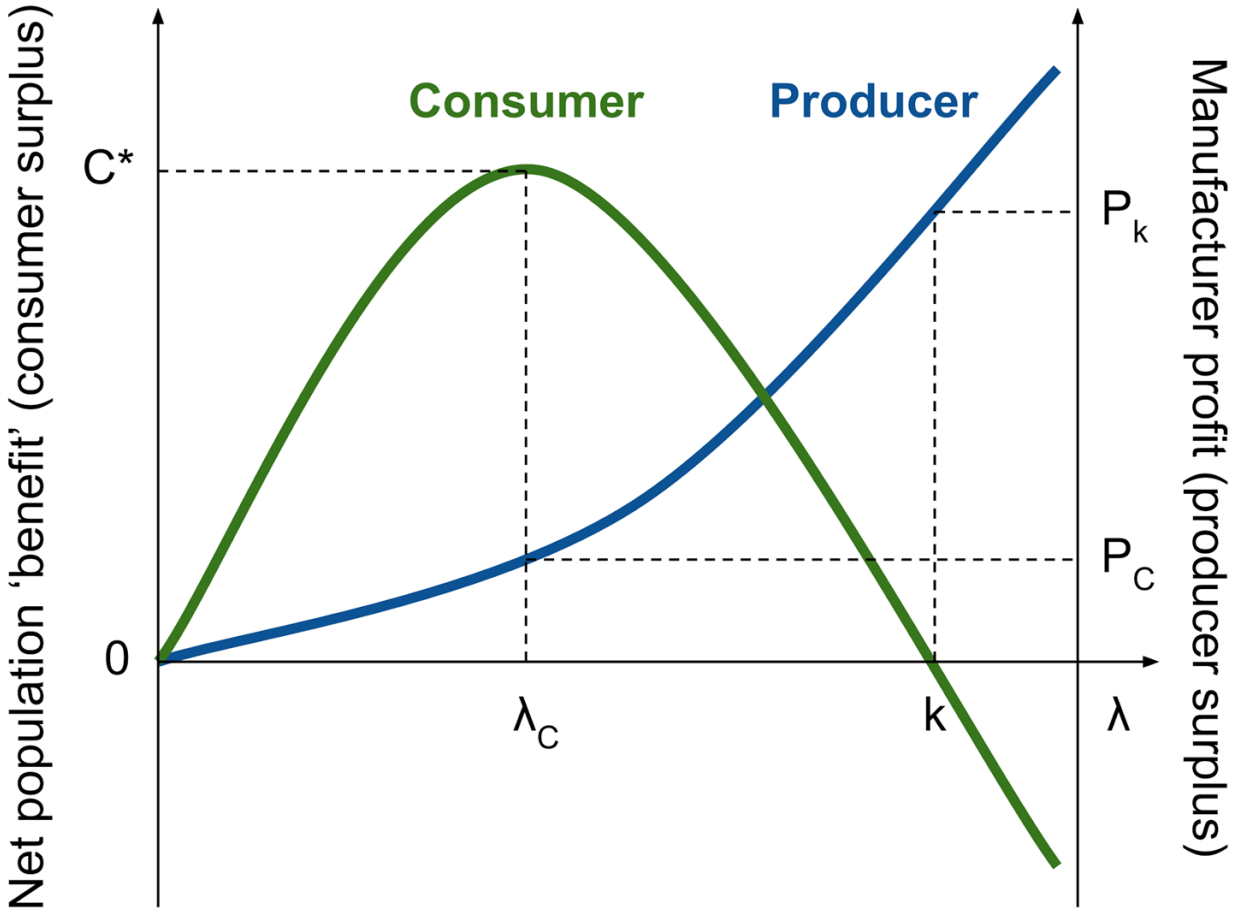
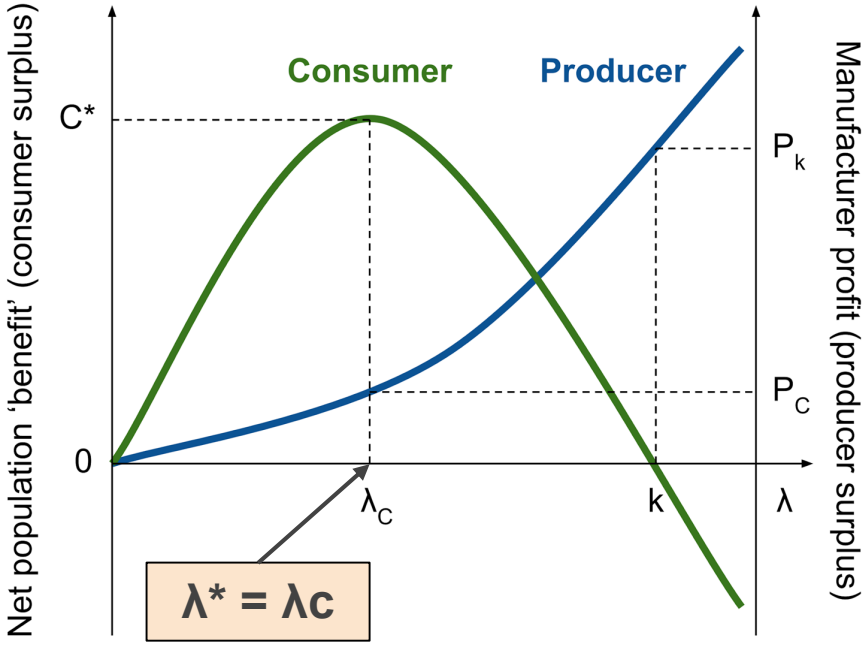
- Unless the measure of ‘benefit’ considered under the consumer perspective is already specified in **monetary terms**, combining consumer and producer surplus requires that each can be considered using a **common metric**
- Whether this is done by **converting consumer surplus into monetary terms** or by **converting producer surplus into units of ‘benefit**’ is immaterial; the challenge is **identifying an appropriate conversion rate**
- **A conventional demand-side threshold provides a natural source for such a conversion rate**, since it provides an estimate of the **monetary value of a unit of ‘benefit’** (denoted as **v**) that **reflects society’s preferences**


Consumer
Producer
C*
0
λ_C
k
λ
P_k
P_C
Net population 'benefit' (consumer surplus)
Manufacturer profit (producer surplus)

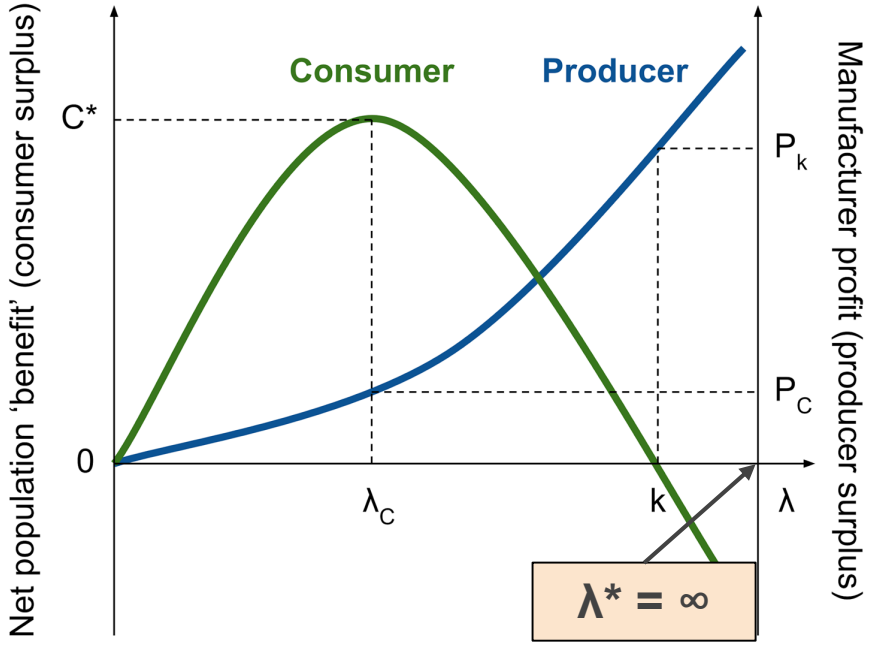
Policy objectives

‘Maximize **consumer** surplus’



Consumer surplus is maximized by **specifying a threshold of λc**.

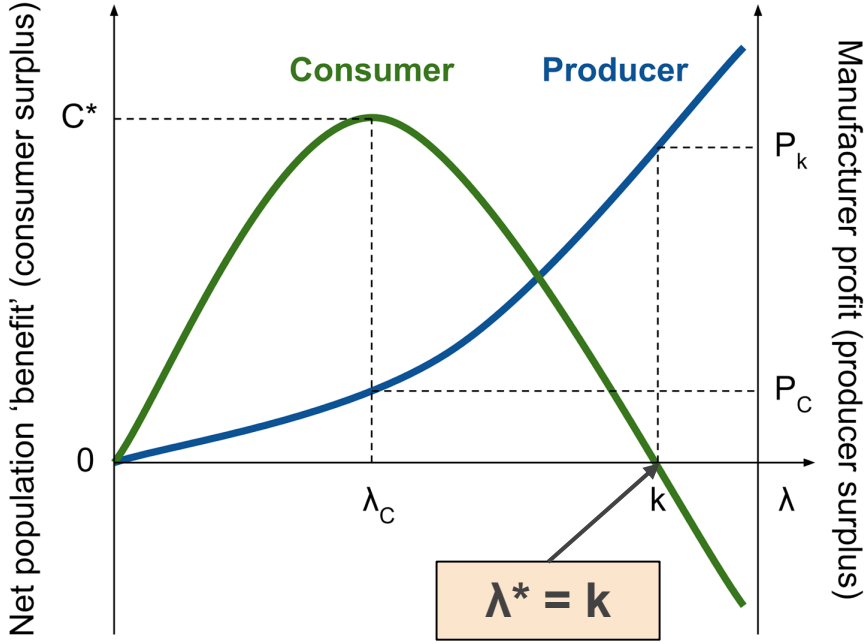
‘Maximize **producer** surplus’



Producer surplus is maximized with an **infinitely high threshold**.

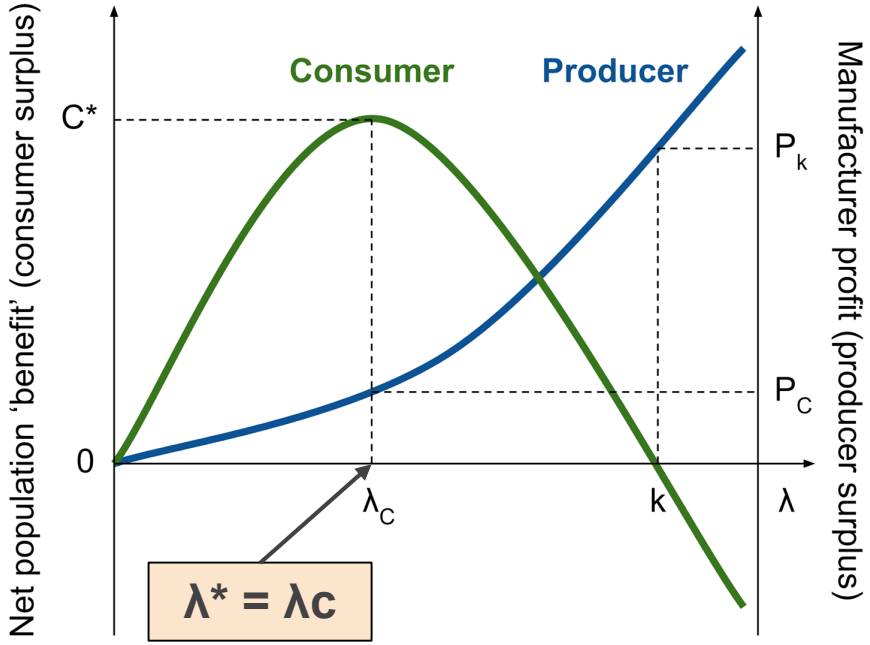
Possible concern: **consumer** surplus is **negative** if **producer** surplus is **maximized**

‘Max **producer** surplus, subject to **consumer** and **producer** surplus each being **non-negative**’



Since producer surplus increases with the threshold, and consumer surplus is negative at any threshold above **k**, this objective is satisfied by specifying a threshold of **k**.

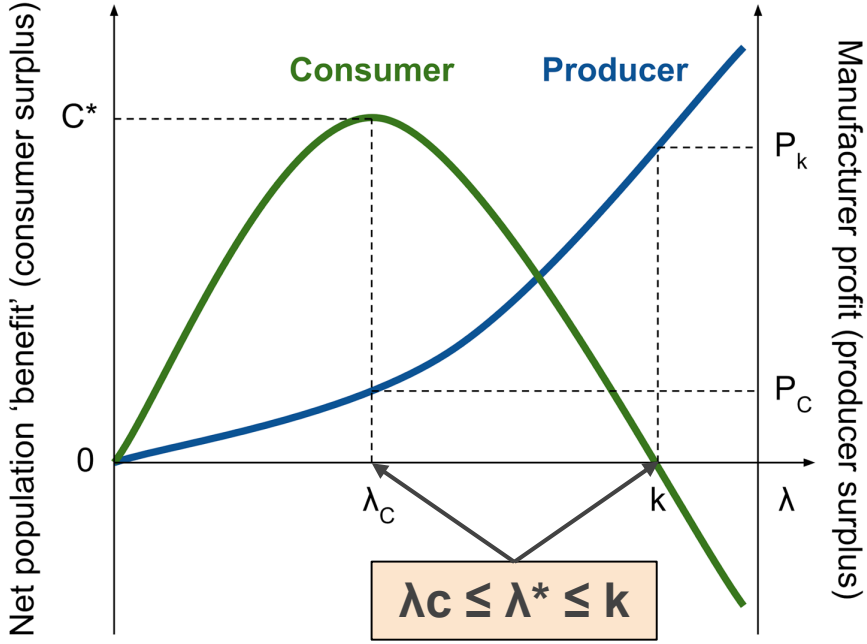
‘Max **consumer** surplus, subject to **consumer** and **producer** surplus each being **non-negative**’



At a threshold of **λc**, consumer surplus is maximized and producer surplus is positive.

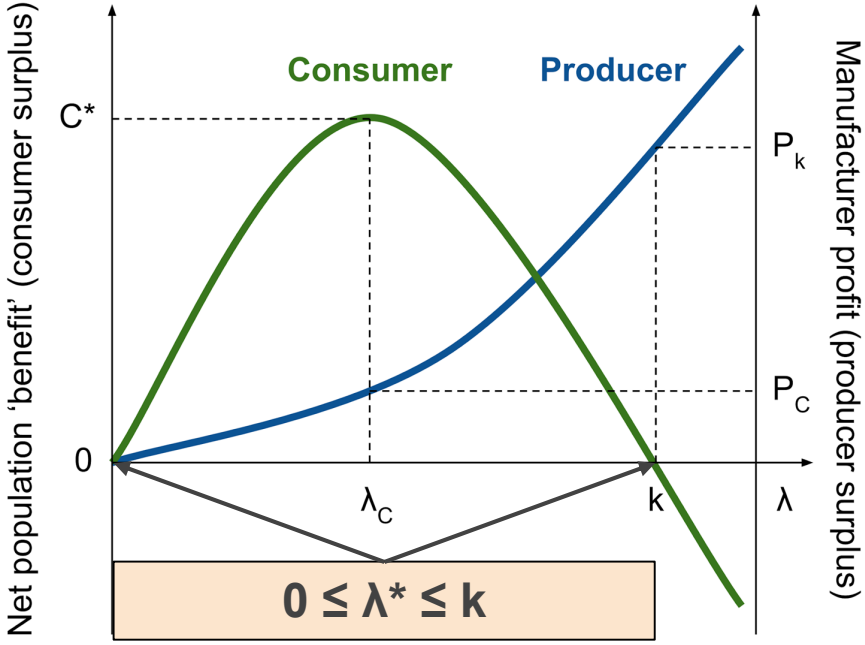
Possible concern: **producer** surplus may comprise a **small proportion** of the **combined** surplus

‘Max **consumer** surplus, subject to **producer** surplus comprising a **guaranteed proportion** of the **combined** surplus and also subject to each being **non-negative**’



The proportion of the combined surplus allocated to producers increases above **λc**. If producer surplus comprises the required proportion at **λc** then this is the optimal threshold. If not, the threshold should be progressively increased until the required proportion is achieved.

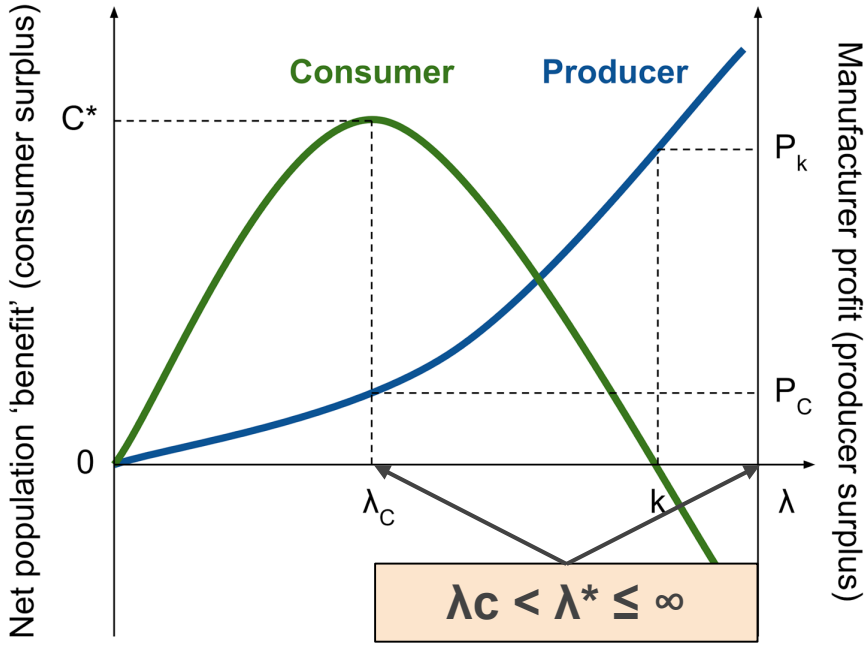
‘Max **producer** surplus, subject to **consumer** surplus comprising a **guaranteed proportion** of the **combined** surplus and also subject to each being **non-negative**’



The maximum threshold at which each is non-negative is **k**. The optimal threshold is derived by progressively lowering the threshold from **k** until the required proportion of consumer surplus is achieved.

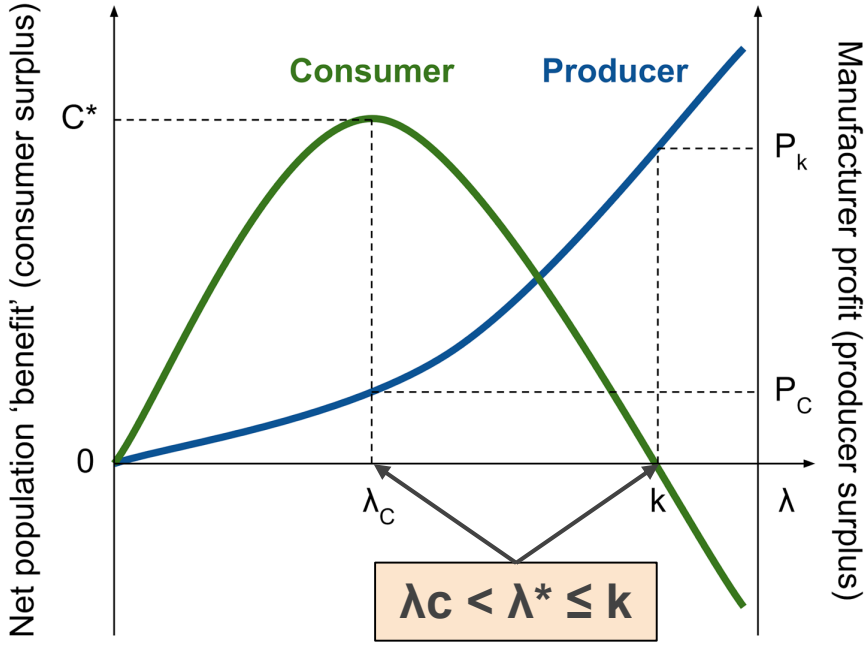
Possible concern: policy maker may wish to **maximize** *neither* **consumer** *nor* **producer** surplus, but rather the **combined** surplus

‘Maximize the **combined** surplus’



Consumer and producer surplus both increase with the threshold up to **λc**. Above **λc**, consumer surplus falls and producer surplus increases. The optimal threshold depends upon the shape of each threshold curve but must exceed **λc**.

‘Maximize the **combined** surplus, subject to each being **non-negative**’



Since consumer and producer surplus both increase with the threshold up to **λc**, but consumer surplus is negative above **k**, the optimal threshold must lie between **λc** and **k**.

Conclusions

Implications for policy, theory, and empirical research

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- The **‘optimal’ threshold** depends critically upon the **policy objective**
- **Neither conventional approach to specifying a threshold is appropriate**, *except under special circumstances* - **under many policy objectives considered, a supply-side approach over-estimates the threshold**
- **A conventional demand-side threshold is not irrelevant -** it can be used to convert consumer and producer surplus into a **common metric**
- Future **empirical research** must estimate **not only k and v,** but also the **shapes of the consumer and producer threshold curves**

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Any questions?