Measuring Novelty of Innovative Outcomes

For Session 4: “Establishing Benchmark for Global Innovation System”

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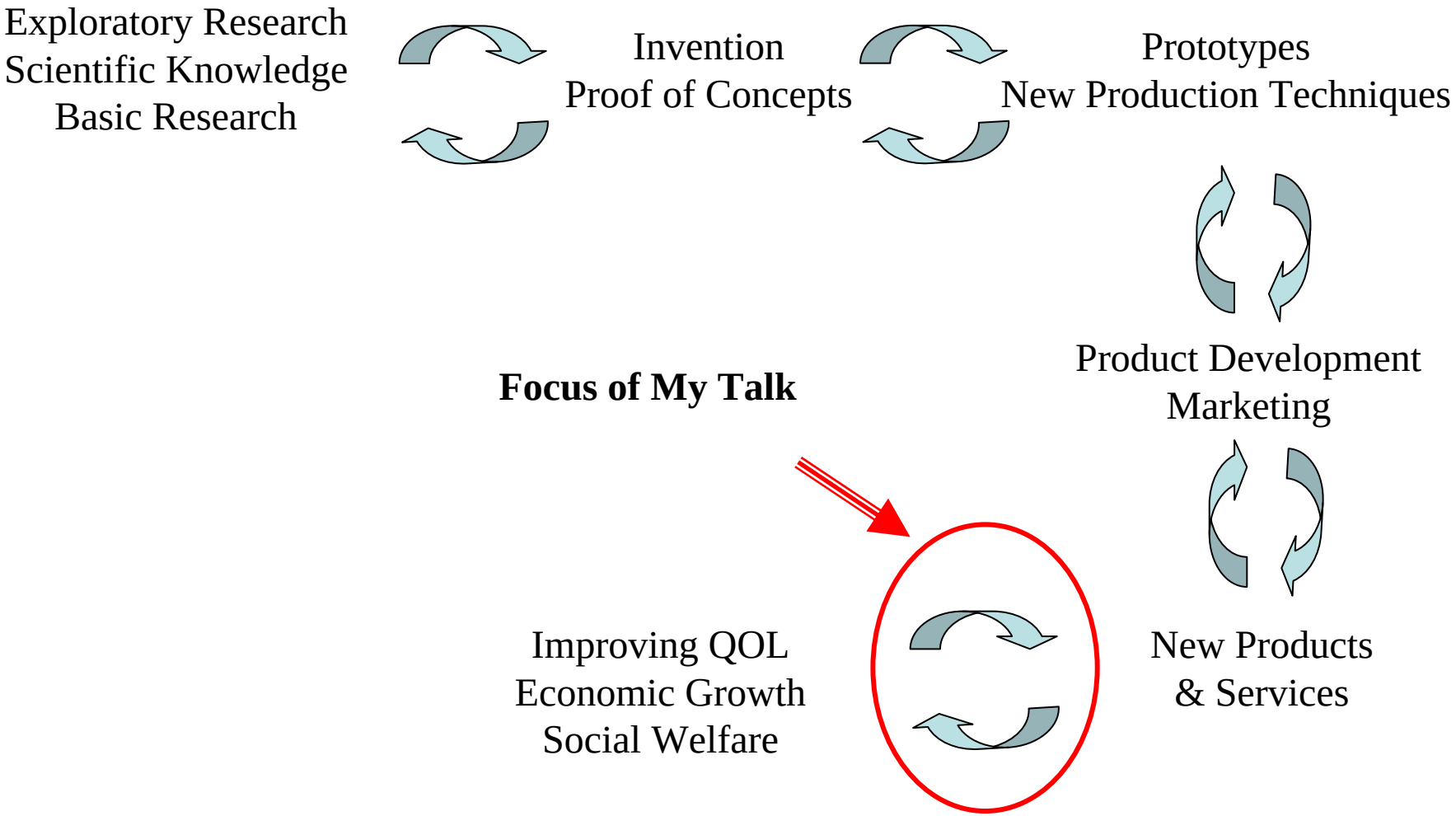
Policy Needs to Assess Innovation

A sequence of STI policies in Japan, in accordance with US and Europe.

- ✓ Third Science and Technology Basic Plan (2006)
- ✓ Innovation 25 (2007)

- To further promote innovation policies in Japan, increasing interests are on the assessment of the policy impact on innovative activities and outcomes (recent efforts made by NISTEP to assess innovative activities).
- To do so, we need to have a consensus as to how to measure outcomes of innovations.
- The purpose of the talk is to summarize a measure by which we can evaluate outcomes of innovation.

Focus of My Talk



Innovations and Welfare

Many technological progress are embedded in new goods.

Economic Importance of new goods ultimately lies in their contributions to our welfare, or Quality of Life.

How to Measure Outcome of Innovation

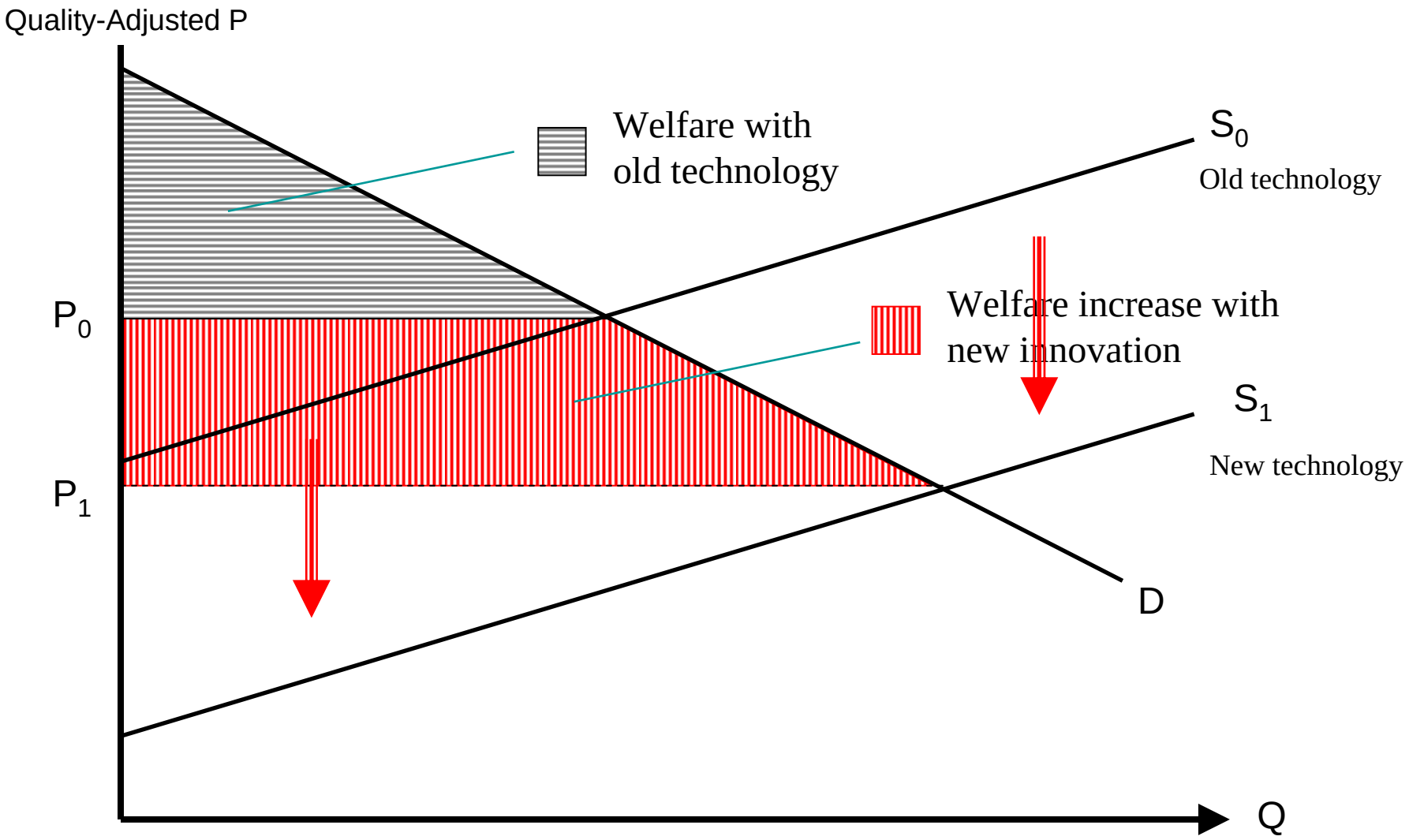
- We wish to assess the extent to which the way we live and work is improved by outcomes of innovation.
- Since changes in welfare cannot be directly observed, we need to have an analytical framework in the assessment of welfare.
- Economics provides a useful framework to quantify (in monetary term) such welfare benefits accrued by innovation.
  - Other discipline (for example, medicine) also assesses welfare based on questionnaire data. Such "stated preference" method is, however, often vulnerable to subjective views of respondents.
  - The method discussed here is robust to the above criticism; it can apply not only to the questionnaire data, but also to market transaction data based on which we infer welfare of innovation outcomes.

Two Views on Innovations

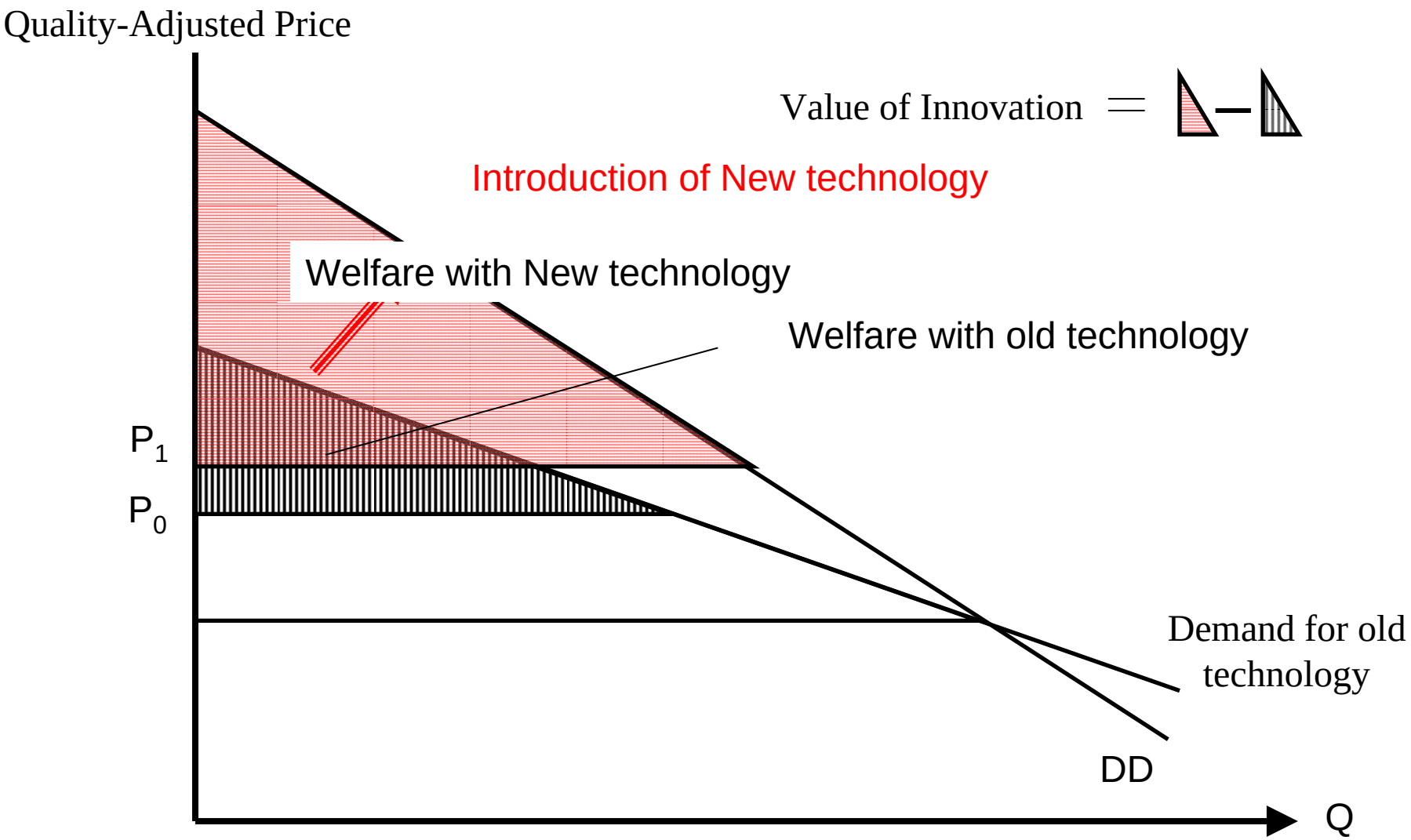
- Product Innovations – outcome of innovation provides a fundamentally different value to us (e.g.. first-introduced penicillin)
- Process Innovation – outcome of innovation provides productivity increase (or, another version of existing goods), e.g.. ATM (i.e., automatic teller machines)

- Innovation can be viewed as either product or process innovations;
  - Computer?
    - Can be thought of as a revolutionary invention.
    - Or, can be viewed as a cheaper version of (calculator, typewriter, and day-planner) combined into one.
  - VCR?
    - Revolutionary time-shifting device
    - A cheaper way to watch recent movies.

Measuring Process Innovation



Measuring Product Innovation



Tools to Measure Welfare

- To estimate (consumer's) welfare, we need information on market demand.
- Since we cannot see demand, we need to estimate it from consumer transaction data, or consumer WTP data.
  - Considerable improvement regarding this estimation technique, including discrete-choice model

- If quality-adjusted prices (P_0 and P_1 in the figures) approximates the change in welfare, these prices can be used to construct cost-of-living (COL) index.

Literature on Evaluating Welfare

As micro-econometric methods are developed, more work to evaluate QOL of innovations, including:

- Cereal of Apple-Cinnamon (Hausman, 1997; $66.8M per year)
- CT Scanners (Trajtenberg, 1987; $14B for 10 years)
- Mini-van (Petrin, 2003, $2.9 B for five years)
- Mobile Phones (Hausman, 1999; $24-49 B per year)
- Satellite TVs (Goolsbee and Petrin, $2.5 B per year)
- VCRs (Ohashi, 2003; value of network effects ranging from $5.6M to $343M per year)

Conclusion and Caveats

- Economics provides useful insights on how to measure outcomes of innovation.
- The method proposed here complements the existing method used in other discipline using questionnaires.
- Since welfare is unobservable, measuring it requires modeling assumptions.
  - Need for checks of robustness and specification
- With increasing interests in quantifying benefits our society enjoys from innovation, researchers need to place more attentions in market transaction data both from consumers and firms viewpoints.

Thank you for your attention!