



AgEcon SEARCH

RESEARCH IN AGRICULTURAL & APPLIED ECONOMICS

The World's Largest Open Access Agricultural & Applied Economics Digital Library

This document is discoverable and free to researchers across the globe due to the work of AgEcon Search.

Help ensure our sustainability.

Give to AgEcon Search

AgEcon Search

<http://ageconsearch.umn.edu>

aesearch@umn.edu

*Papers downloaded from **AgEcon Search** may be used for non-commercial purposes and personal study only. No other use, including posting to another Internet site, is permitted without permission from the copyright owner (not AgEcon Search), or as allowed under the provisions of Fair Use, U.S. Copyright Act, Title 17 U.S.C.*

No endorsement of AgEcon Search or its fundraising activities by the author(s) of the following work or their employer(s) is intended or implied.

Dynamic Efficiency and Productivity Analysis

Alfons Oude Lansink

Selected Paper prepared for presentation at the International Agricultural Trade Research Consortium's (IATRC's) 2013 Symposium: Productivity and Its Impacts on Global Trade, June 2-4, 2013, Seville, Spain

Copyright 2013 by [authors]. All rights reserved. Readers may make verbatim copies of this document for non-commercial purposes by any means, provided that this copyright notice appears on all such copies.

Dynamic Efficiency and Productivity Analysis

Sevilla 2-4 June

Alfons Oude Lansink

(ongoing work with Spiro Stefanou, Elvira Silva)



Overview

- Motivation
- Dynamic Directional Distance Function and Technical inefficiency
- Dynamic Cost function and Cost Inefficiency
- Applications

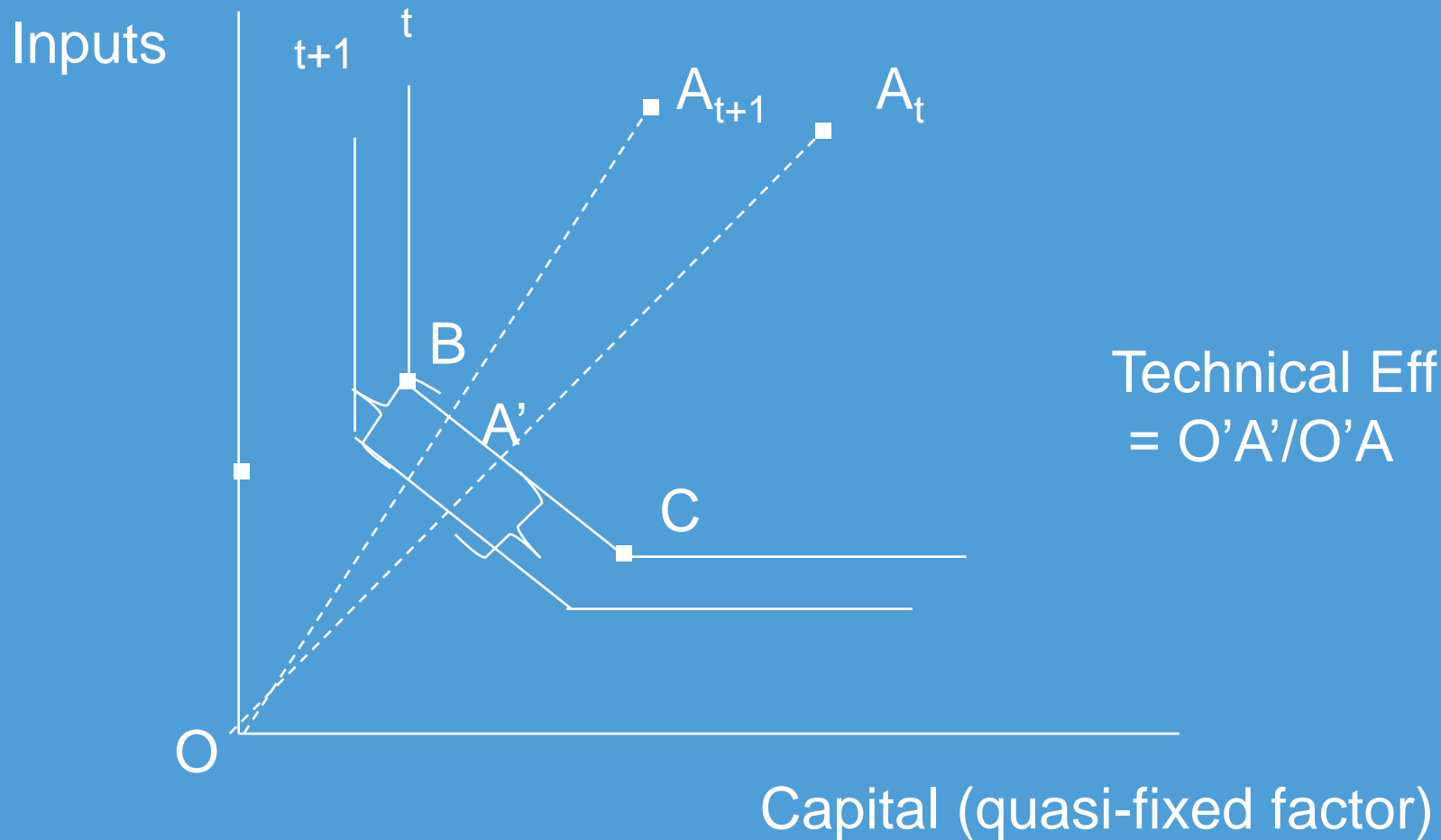


Motivation: Dynamic Technical Efficiency and productivity analysis

- Technical efficiency and total factor productivity are key determinants of the cross country competitiveness
- Technical efficiency reflects the extent to which the production potential is used
- Total factor productivity is usually reflected as a ratio of all outputs and all inputs (e.g. Tornquist, Malmquist) or as a difference between output and inputs (Luenberger)
- Investments in quasi-fixed factors (capital assets) can improve the productivity (better technology, more optimal scale of production)



Motivation: Static Technical Efficiency and productivity Analysis

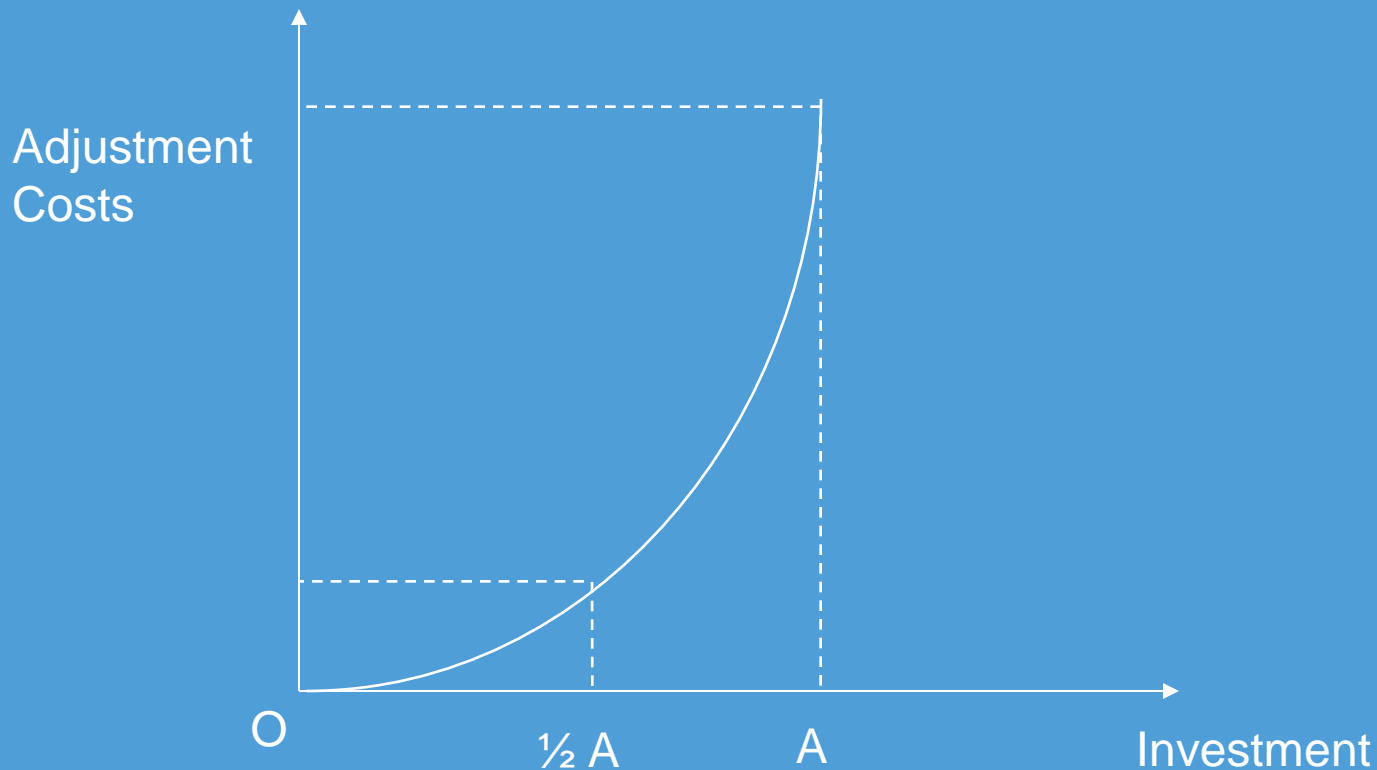


Motivation: Dynamic Technical Efficiency

- Dynamic dimension of technical efficiency and productivity?
- Costs of adjustment in quasi-fixed factors of production
 - Low prices for second hand machinery due to asymmetric information in markets of second hand machinery
 - Environmental costs of disposal of buildings (e.g. asbestos)
 - Costs of capital increase with the size of the amount borrowed.
 - Human capital related costs: Learning costs and search costs



Motivation: Dynamic Technical Efficiency



- ❑ A = Investment needed to achieve the long-run optimal capital stock
- ❑ Cheaper to split investment in two steps of $\frac{1}{2} A$ rather than in one step of size A



Dynamic Technical Efficiency

In the dynamic context the decision maker seeks to:

Minimize

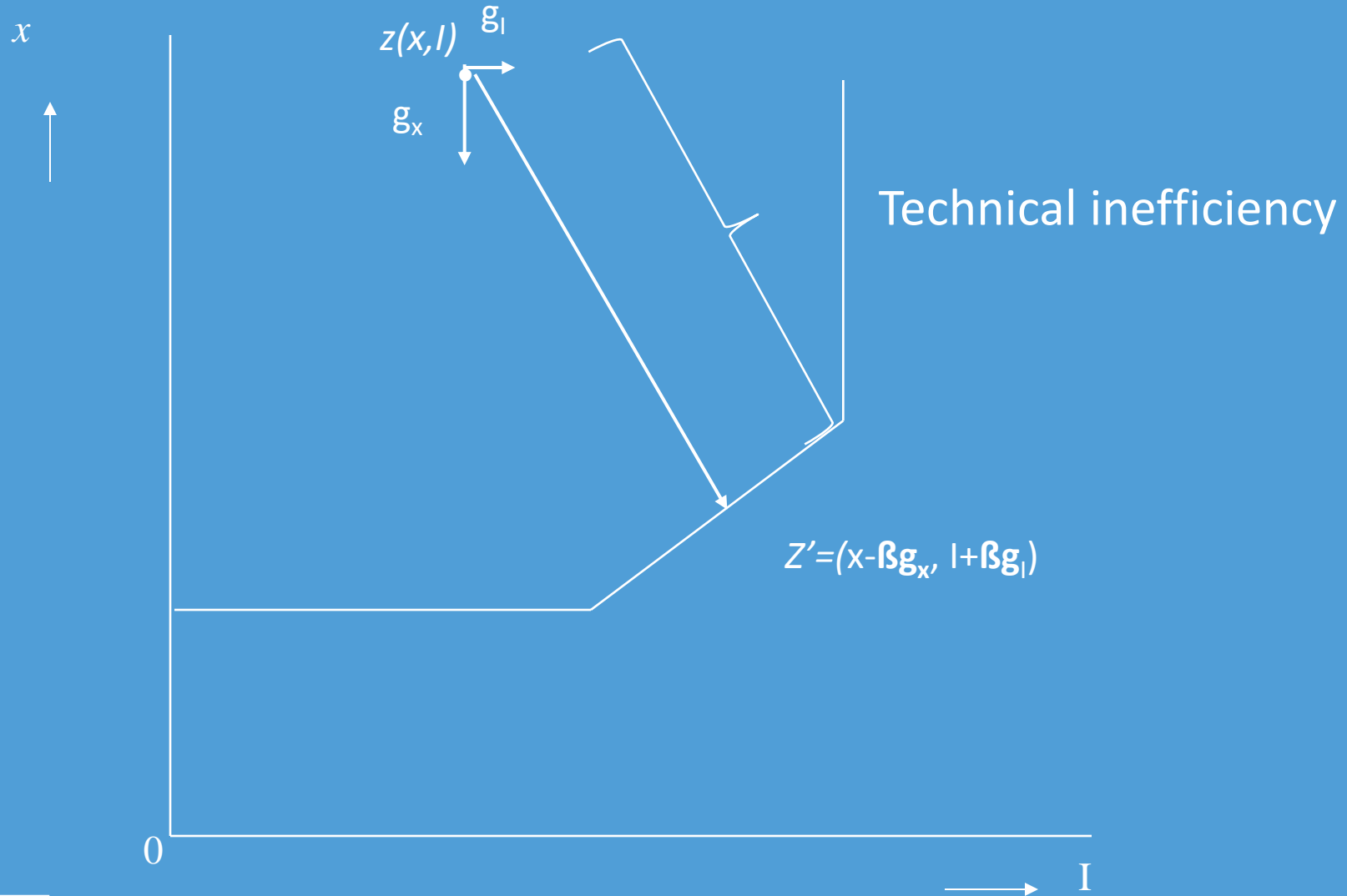
- variable inputs

Maximize

- Investment in quasi-fixed factors
- Variable outputs



Dynamic Directional Input Distance Function and technical inefficiency



Dynamic Directional Input distance function

$$\vec{D}_i(y, x, I, k; g_x, g_I) = \sup \{ \beta : (x - \beta g_x, I + \beta g_I) \in V(y : k) \}$$

$V(y : k)$ Technology : x, I can produce y , given k

y Output vector

x Variable input vector

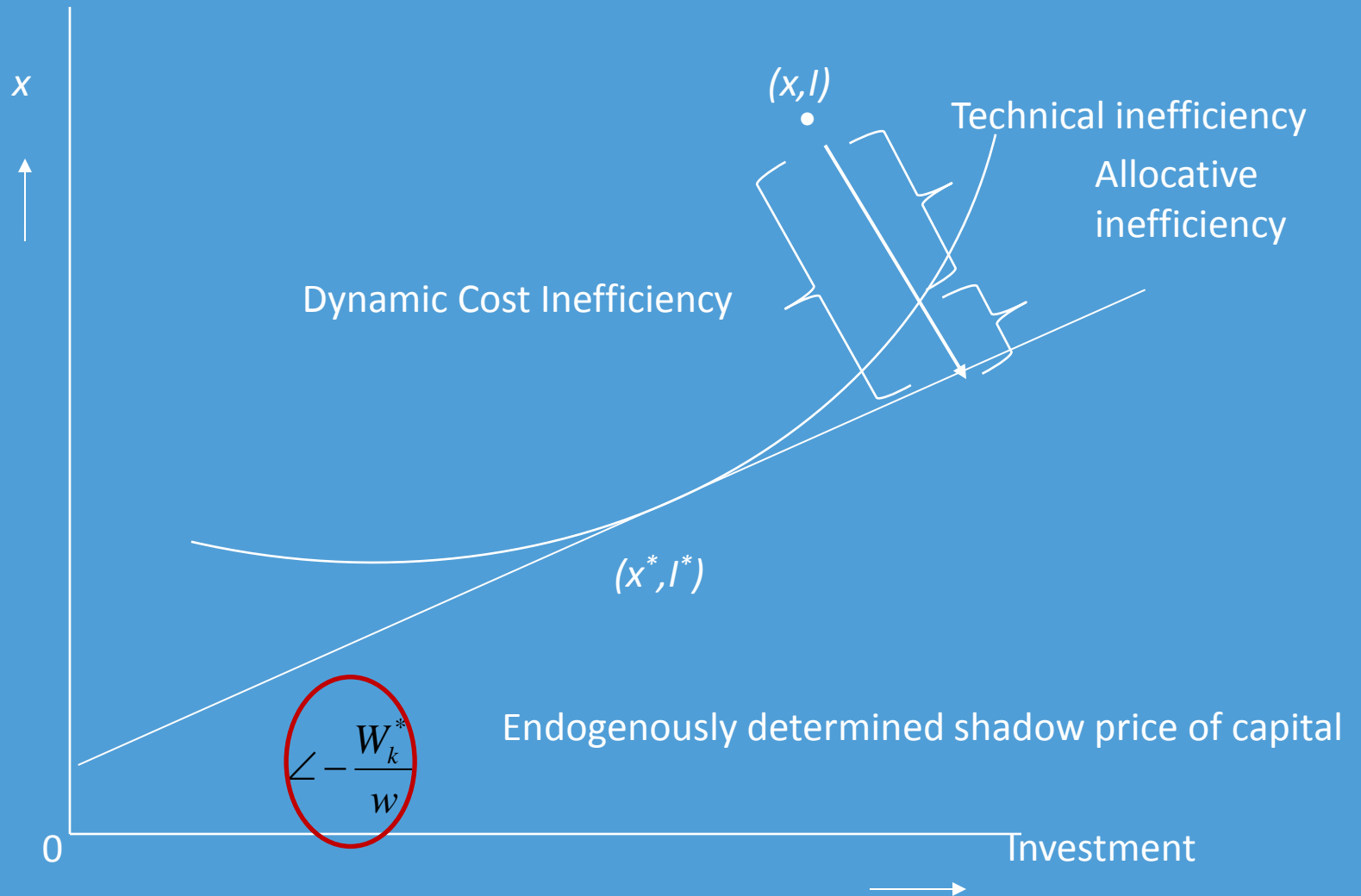
k Quasi – fixed input vector

I Net investment quasi – fixed input

g_x, g_I Directional dist. vectors



Dynamic Cost Inefficiency



Dynamic Cost function: Cost minimization

$$rW(w, c, k, L, y) = \min \{ wx + ck + W_k (I - \delta k) \}$$

$$s.t. \quad \vec{D}(y, x, I, k, L; g_x, g_I) \geq 0$$

$W(\cdot)$ = Intertemporal Shadow Cost Function

w, x = price, quantity variable inputs

c, k = price, quantity quasi fixed inputs

W_k = Shadow value capital

I = Investments

δ = Depreciation rate

y = Output

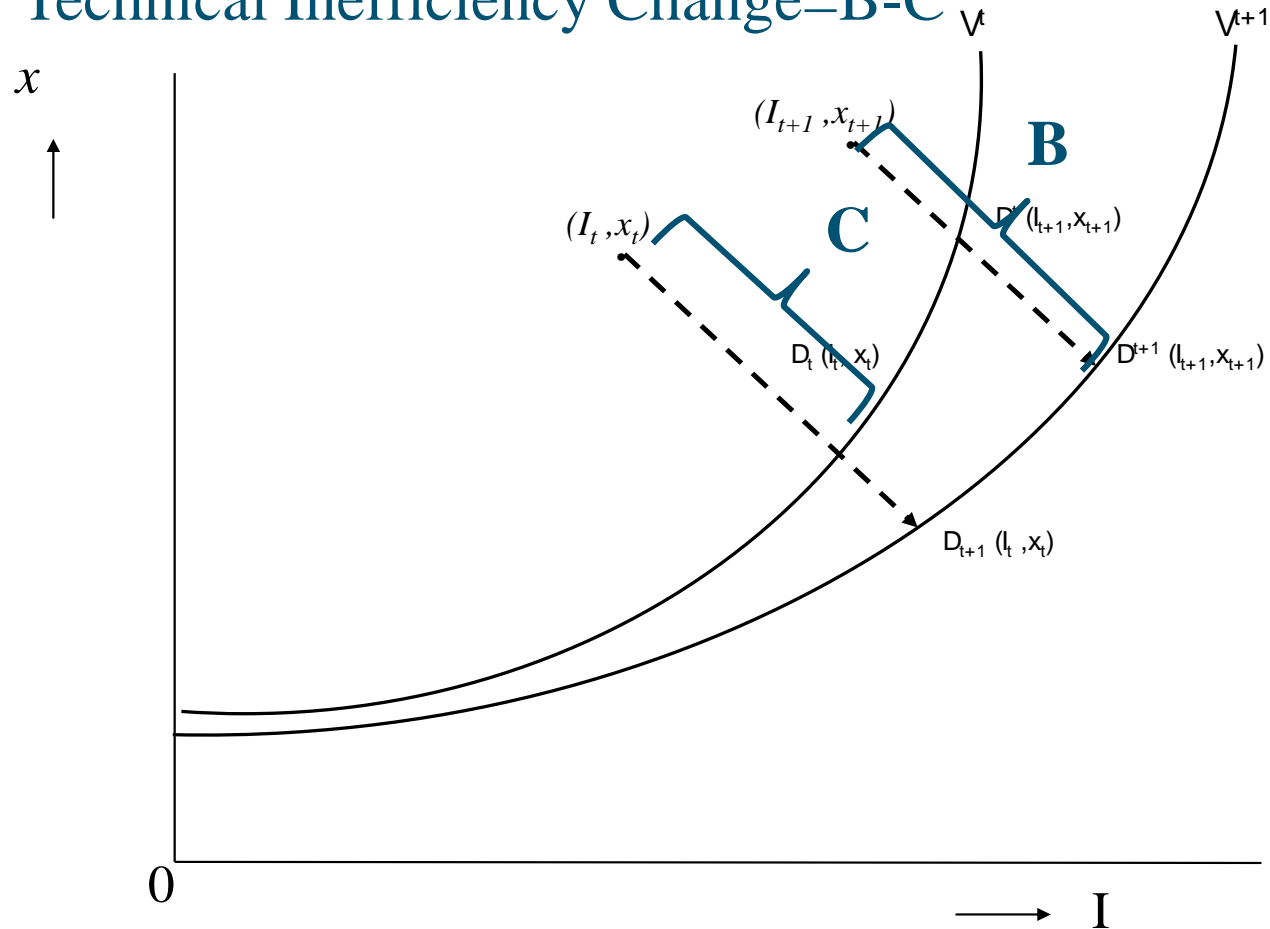
g_x, g_I = Directional distance vectors of x and I



Dynamic Luenberger TFP growth Indicator

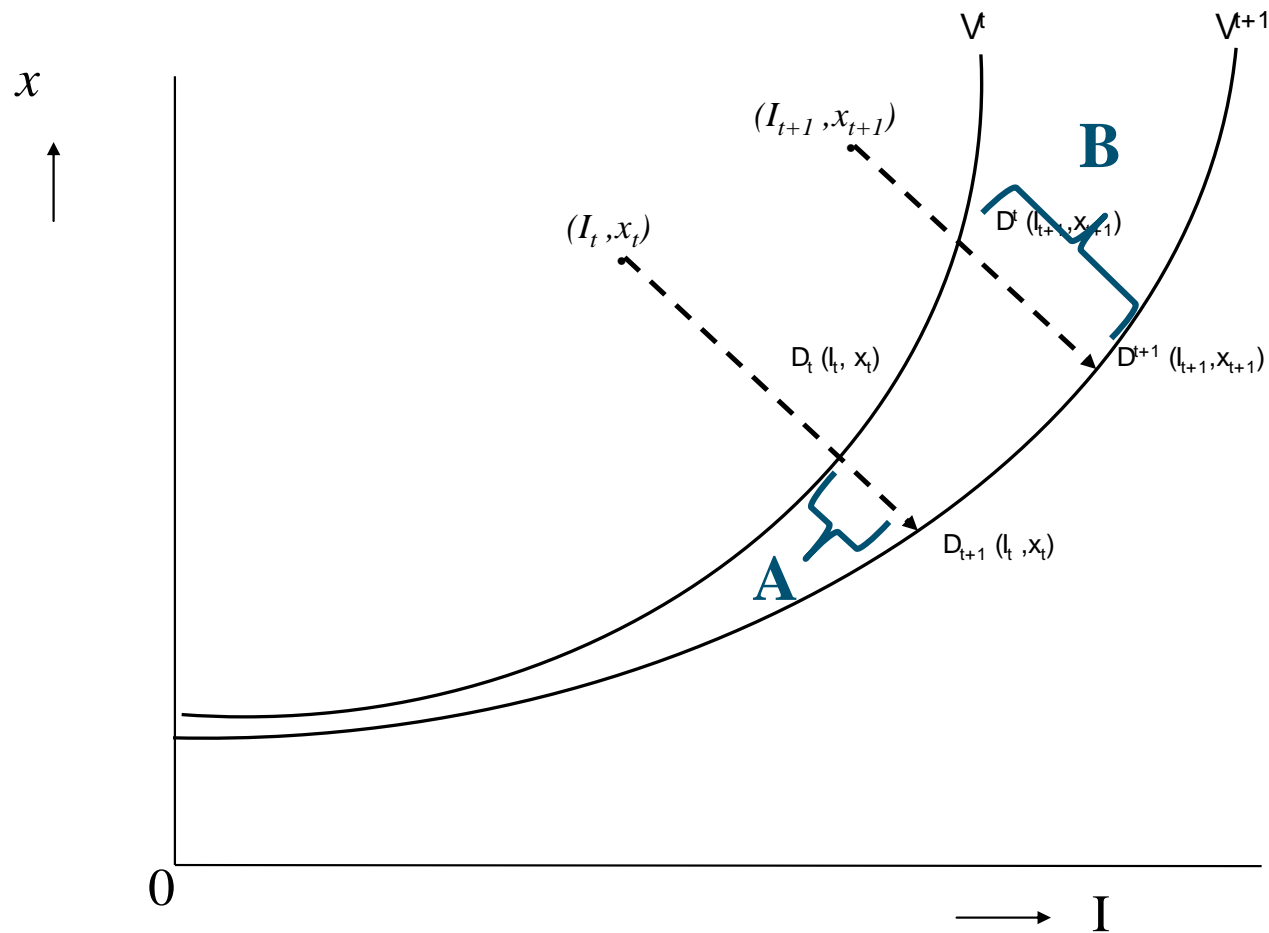
Technical inefficiency in $t = C$ and in $t+1$ it is B

Technical Inefficiency Change = $B - C$



Dynamic Luenberger TFP growth Indicator

$$\text{Technical Change} = \frac{1}{2}(A+B)$$



Application (DEA): Data Dutch Horticulture



- Specialized vegetables (greenhouse) firms in the Netherlands
- Main outputs: Peppers, Cucumbers, Tomatoes
- Farm Accountancy Data: 265 observations from 103 farms
- Data Envelopment Analysis was used to estimate dynamic technical, allocative and cost inefficiency



Results: Dynamic Technical, Allocative and Overall Cost Inefficiency

| Period | Technical inefficiency |
|-----------|---------------------------|
| 1997 | 0.39 |
| 1998 | 0.34 |
| 1999 | 0.26 |
| 1997-1999 | 0.33 |

Application (parametric): Data Dutch Dairy



- Specialized dairy farms from Farm Accountancy Data Network
- Main outputs: milk, beef plus some crops
- 80% of revenues are from milk
- 2614 observations from 669 farms

Empirical Specification

- Quadratic dynamic directional distance function
- Normalized Quadratic dynamic cost frontier
- Results: Serra, Oude Lansink and Stefanou, 2011 (*American Journal of Agricultural Economics*)



Results: Dynamic Technical, Allocative and Overall Cost Inefficiency

| Period | Technical inefficiency |
|-----------|---------------------------|
| 1995-2000 | 0.100 |
| 2001-2005 | 0.107 |
| Mean | 0.104 |

Application: Dynamic versus Static productivity growth in the Spanish Meat processing Industry



- More EU regulation regarding food safety, consumer information and sustainable practices. Leads to productivity decline?
- Data from Spanish meat processing firms (SABI data base)
- 928-1527 firms per year in the period 2000-2010
- Static Malmquist compared with dynamic Luenberger



Productivity growth Spanish Meat Processing firms

- Total Factor Productivity growth (static and dynamic)
 - Technical change
 - Technical efficiency change
 - Scale efficiency change



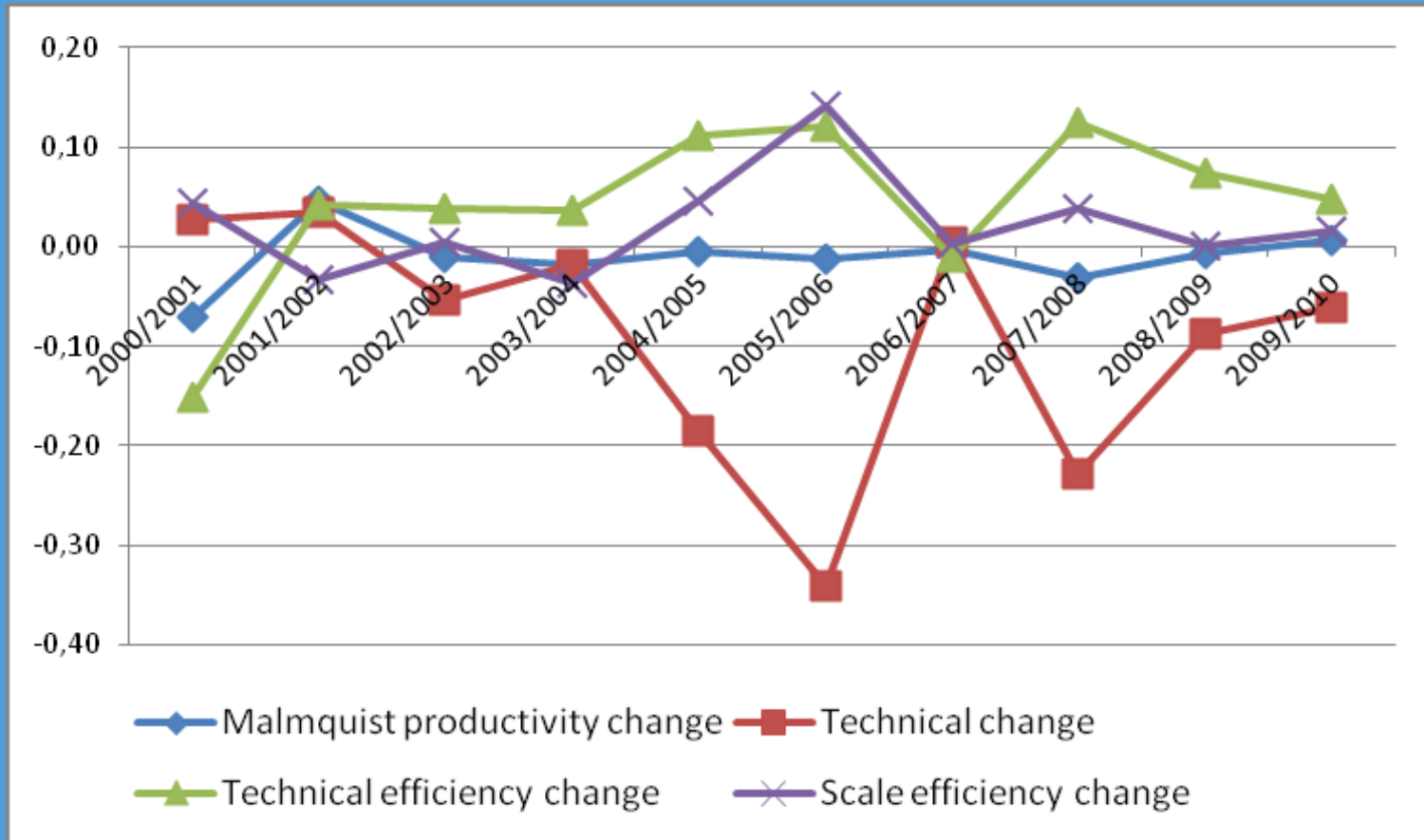
Results: Static versus Dynamic measures (2000-2010)

| Static Malmquist productivity change | Technical change | Technical efficiency change | Scale efficiency change |
|---|-------------------------|------------------------------------|--------------------------------|
| -0.010 | -0.093 | 0.052 | 0.025 |

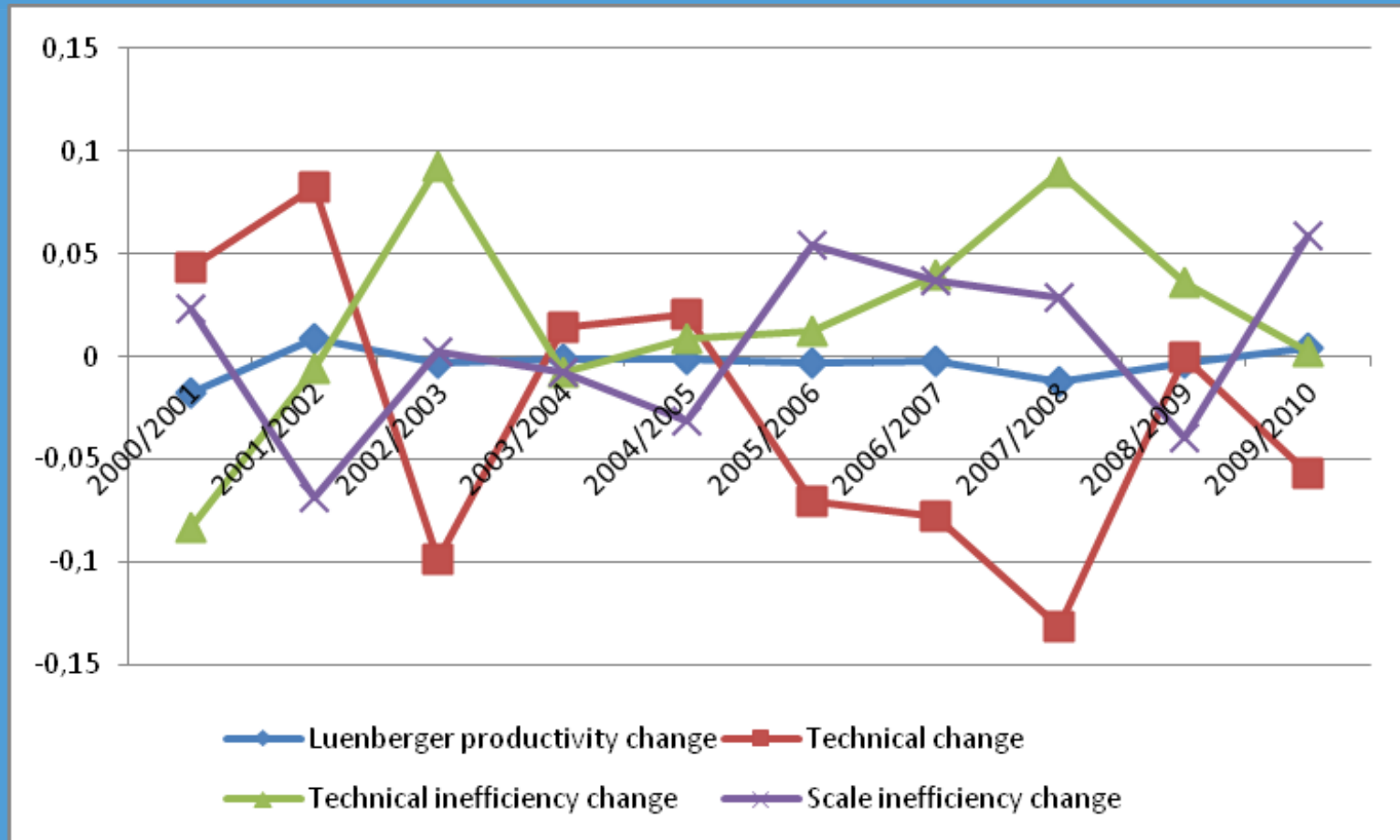
| Dynamic Luenberger productivity change | Technical change | Technical inefficiency change | Scale inefficiency change |
|---|-------------------------|--------------------------------------|----------------------------------|
| -0.003 | -0.031 | 0.022 | 0.005 |



Results: Evolution of Malmquist index and its components



Results: Evolution of the Luenberger indicator and its components



Conclusions

- Adjustment costs of investments in quasi fixed factors may have a (temporary) downward impact on the production potential
- Hence cross country competitiveness of countries with substantial investments may be temporarily negatively affected.
- Static models do not properly reflect the dynamic nature of capital and may misrepresent the sources of productivity growth



Thank you!



WAGENINGEN UR
For quality of life