Productivity and International Competitiveness of Agriculture in the European Union and the United States

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Productivity and International Competitiveness

• The Doha Round of trade negotiations has stagnated, with the European Union and the United States at an impasse over the level of support for agriculture and the need for increased market access

• These "trade frictions" have accompanied the rapid expansion of European exports to the United States

• Explanations for the resulting trade imbalance must include variations in exchange rates, changes in relative prices of factors of production, and the relative rate of growth of total factor productivity

• We analyze the role of each of these factors in explaining the increased competitiveness of European Union agriculture relative to its United States counterpart

• At the outset it is necessary to define a measure of international competitiveness.

• Our measure of international competitiveness is the price of output in the Member States relative to that in the United States

• An important assumption underlying our approach is that markets are competitive and in long-run equilibrium, so that the price of output always equals average total costs

• This assumption is used to decompose relative price movements into changes in relative input prices and changes in relative productivity levels

• We calculate relative price levels and relative levels of productivity in eleven Member States—Belgium, Denmark, Germany, Greece, Spain, France, Ireland, Italy, the Netherlands, Sweden, and the United Kingdom—for the period 1973-2002

- Relative output prices can be summarized by means of purchasing power parities

- These are relative prices of output in each country expressed in terms of national currencies per dollar

- The dimensions of the purchasing power parities are the same as exchange rates

- However, the purchasing power parities reflect prices of goods and services that make up industry output

- To account for changes in international competitiveness, we calculate purchasing power parities for factor inputs—capital, land, labor, and intermediate goods

• The final step in accounting for changes in international competitiveness is to measure relative levels of productivity for all countries in the comparison

• For this purpose, we employ a multilateral model of production where the price of output (or unit cost) in each country is expressed as a function of prices of the inputs and the level of productivity in that country

• We account for the relative prices of output among countries by allowing input prices and levels of productivity to differ among countries

Theoretical Framework

• Under competitive conditions we can represent technology by the dual price (equivalently, unit cost) function for all twelve countries:

$$\ln P = \sum_i \alpha_i \ln W_i + \alpha_t T + \sum_d \alpha_d D_d + \frac{1}{2}\sum_i \sum_j \beta_{ij} \ln W_i \ln W_j + \sum_i \beta_{it} \ln W_i T$$

$$+ \sum_i \sum_d \beta_{id} \ln W_i D_d + \frac{1}{2}\beta_{tt} T^2 + \sum_d \beta_{td} T D_d + \frac{1}{2}\sum_d \beta_{dd} D_d{}^2,$$

where P is the price of output, the W_i are input prices, T is time, D_d is a country dummy variable, and d is an index of countries

• In explaining differences in production patterns, we combine the price function with the demand functions for inputs

• We express these functions as equalities between the share of each input in the value of output and the elasticity of the output price with respect to the price of that input:

$$v_{X_i} = \frac{\partial \ln P}{\partial \ln W_i} = \alpha_i + \sum_j \beta_{ij} \ln W_j + \beta_{it} T + \beta_{id} D_d$$

• The sum of the elasticities with respect to all inputs equals unity, so that the value shares also sum to unity

• We define the rate of productivity growth, say v_T, as the negative of the rate of growth of the output price with respect to time, holding input prices and the country dummy variables constant:

$$-v_T = \frac{\partial \ln P}{\partial T} = \alpha_t + \sum_i \beta_{it} \ln W_i + \beta_{tt} T + \beta_{td} D_d$$

• Similarly, we define the difference in technology between any country and the United States, say v_d, as the negative of the rate of growth of the price of output with respect to the dummy variable, holding input prices and time constant:

$$-v_d = \frac{\partial \ln P}{\partial D_d} = \alpha_d + \beta_{id} \ln W_i + \beta_{td} T + \beta_{dd} D_d$$

• The rates of productivity growth are not directly observable, but average rates of productivity growth between two points in time, say *T* and *T*-1, can be expressed as the difference between a weighted average of growth rates of input prices and the growth rate of the price of output:

$$-\bar{v}_T = \ln P(T) - \ln P(T-1) - \sum_i \bar{v}_{X_i} [\ln W_i(T) - \ln W_i(T-1)],$$

where the average rate of technical change is

$$\bar{v}_T = \frac{1}{2}[v_T(T) + v_T(T-1)],$$

and the weights are given by the average value shares

$$\bar{v}_{X_i} = \frac{1}{2}[v_{X_i}(T) + v_{X_i}(T-1)]$$

• The differences in productivity v_d can be expressed as weighted averages of the differences between logarithms of the input prices for each country and the geometric mean of input prices for all twelve countries, less the difference between logarithms of the output price:

$$-\hat{v}_d = \ln P(d) - \ln P(US) - \sum_i \hat{v}_{X_i}(d)[\ln W_i(d) - \overline{\ln W_i}] + \sum_i \hat{v}_{X_i}(US)[\ln W_i(US) - \overline{\ln W_i}]$$

where

$$\hat{v}_{X_i}(d) = \frac{1}{2}[v_{X_i}(d) + \frac{1}{N}\sum_d v_{X_i}(d)]$$

and a bar indicates the average over all *N* countries

Production Accounts

• The production accounts for each country in the comparison are consistent with a gross output model of production

• Output is defined as gross production leaving the farm, as opposed to real value added

• Inputs are not limited to labor and capital but include intermediate inputs as well

• One unconventional aspect of our measure of total output is the inclusion of output from "inseparable" secondary activities

• These activities are defined as activities whose costs cannot be observed separately from those of the primary agricultural activity

 • Two types of secondary activities are distinguished.

• The first represents a continuation of the agricultural activity, such as the processing and packaging of agricultural products on the farm, while services relating to agricultural production, such as machine services for hire, are typical of the second

• The total output of the industry represents the sum of output of agricultural goods and the output of goods and services from secondary activities

• We evaluate industry output from the point of view of the producer; that is, subsidies are added and indirect taxes are subtracted from market values

• Similarly, the value of each input is defined from the purchaser's point of view

• The value of intermediate input includes taxes (other than the deductible VAT) less subsidies, whether paid to suppliers of intermediate goods or to agricultural producers

• The value of capital service flows reflects subsidies on purchases of new capital goods

Purchasing Power Parities

• We estimate purchasing power parities for output and for capital, land, labor and intermediate inputs in 1996 for the eleven European Union countries and the United States

• These are relative prices of output in each country expressed in terms of national currency per dollar

• We divide the relative price of output by the exchange rate to translate the purchasing power parities into relative prices in dollars

Relative Prices, 1996

• The levels of output prices in the eleven European countries in 1996 were well above the United States price level

• The relative price of output was highest in Sweden at 1.629, followed by the United Kingdom at 1.602, and Greece at 1.505

• The Netherlands was found to have the lowest output price relative to the United States in 1996 at 1.338

- The European countries also faced higher prices for intermediate inputs in 1996

- Relative prices ranged from 1.35 in Denmark to 1.055 in Ireland

- The cost of capital input, other than land, exceeded that in the United States in all of the European countries except Germany, Ireland, and Italy

- Among the eleven European countries, only Sweden had a lower price of land input in 1996

- By contrast, the purchasing power parities for labor input in 1996 represent substantially lower wage rates in the European countries relative to the United States

Relative Prices, 1973-2002

• We have estimated relative output and input prices in the eleven European countries and the United States in 1996

• We have also compiled price indexes for output and inputs in each country for the period 1973-2002

• We obtain estimates of output and input prices in each country relative to those in the United States for each year by linking these time-series price indexes with estimates of relative prices for the base period

- The index of relative output prices was 0.574 in Ireland in 1973, while that in the United States was 0.637

- The price index in the United Kingdom was 0.603

- These results imply that Ireland and the United Kingdom had a competitive advantage relative to the United States in 1973

- Output prices in the other countries in the comparison were well above the level in the United States in 1973

• The levels of output prices in the eleven European countries increased relative to the United States during the 1970s

• This was a consequence of more rapid inflation in most European countries and an appreciation of the European currencies relative to the dollar through 1980

• The competitiveness of United States agriculture reached a temporary peak in that year

- The situation changed in the early 1980s

- By then the OECD countries were vigorously pursuing anti-inflationary policies

- The change to restrictive monetary policy initiated by the Federal Reserve pushed up interest rates sharply

- The dollar appreciated on foreign exchange markets, and world export prices started to fall

- By 1984 the price level in most European countries was well below the United States price

- This had the short-run effect of restoring the competitiveness of European agriculture

- Furthermore, the European Union, under its Common Agricultural Policy, embarked on a program of subsidized grain sales to increase its market share of world exports

- This came largely at the expense of the United States

- The United States inflation rate slowed between 1981 and 1986

- This was followed by a rapid depreciation of the dollar

- By 1986 price levels in the European countries, denominated in dollars, once again exceeded the United States price

• The continued weakness of the dollar through the early 1990s resulted in a further deterioration of the international competitiveness of European agriculture

• By 1995 prices in most European countries were at their highest level relative to the United States

• But a strengthening dollar between 1996 and 2001 eroded much of the competitive advantage of the United States

- Another factor contributing to the decline in relative prices in the European Union was a series of reforms of the Common Agricultural Policy that culminated in the MacSharry Reforms of 1992

- The package of reforms lowered intervention prices for grains, oilseeds, and protein crops and for beef and sheepmeat

- To compensate for loss of revenue farmers would receive direct payments based in part on historical yields and planted area

- Guaranteed prices were further reduced by Agenda 2000

• Our comparisons of relative prices show, first, that United States agriculture has been more competitive than its European counterparts throughout the period 1973-2002, except for the years 1973-74 and 1983-85

• Second, lower costs of materials, capital, and land inputs contributed to United States international competitiveness for most of this period

Trends of Relative Output Prices Denominated in Dollars
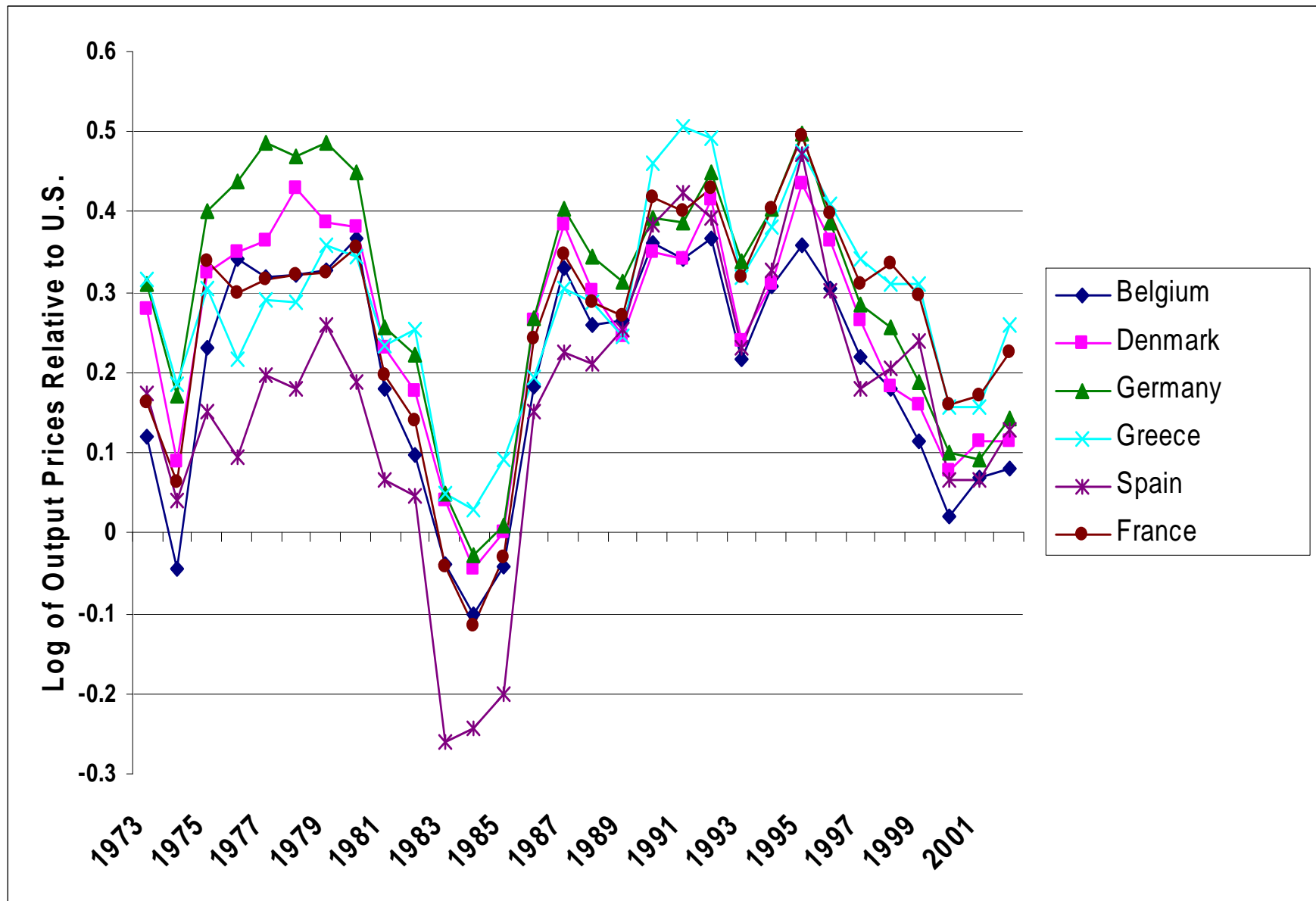
# Trends of Relative Output Prices Denominated in Dollars (Cont.)
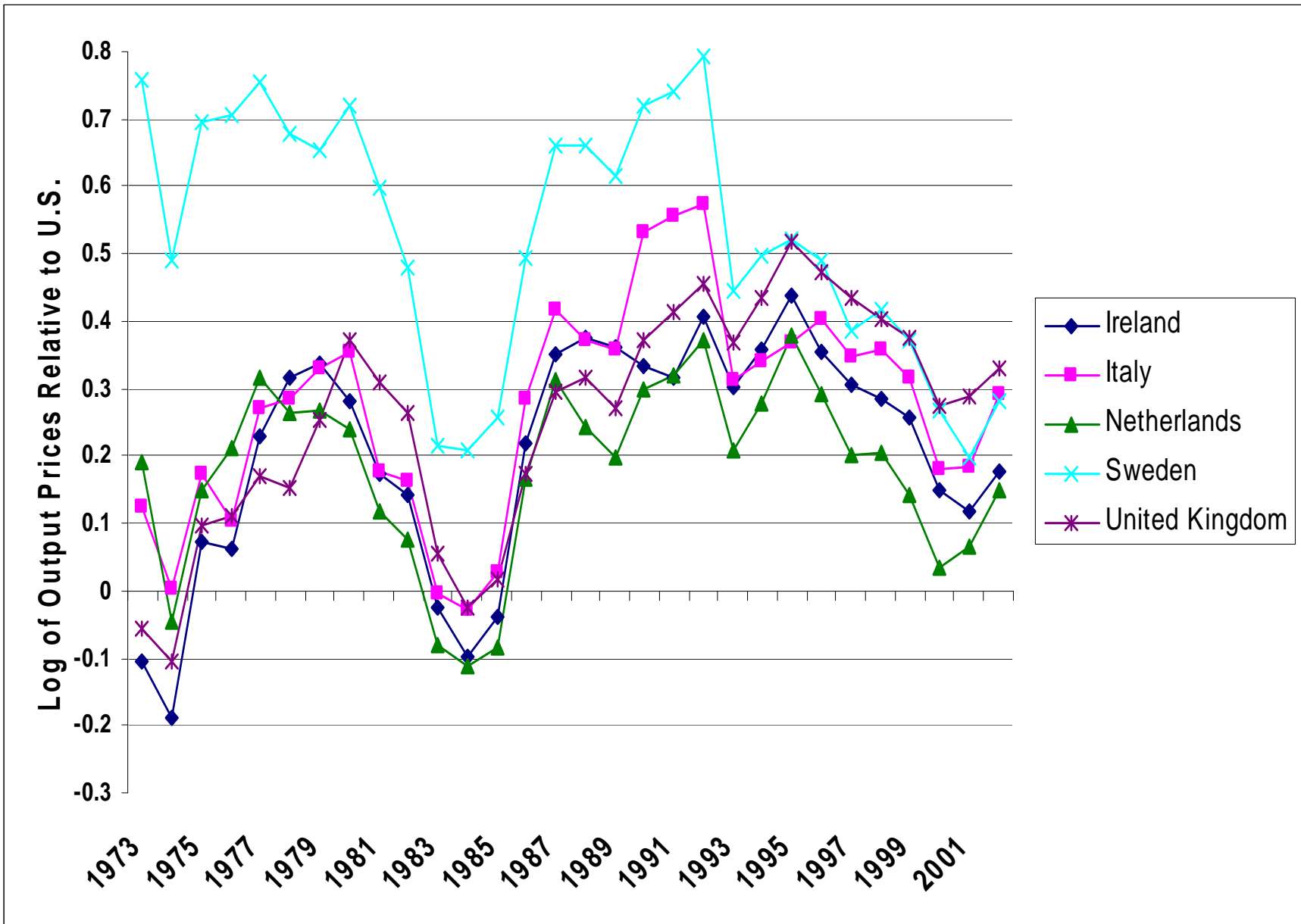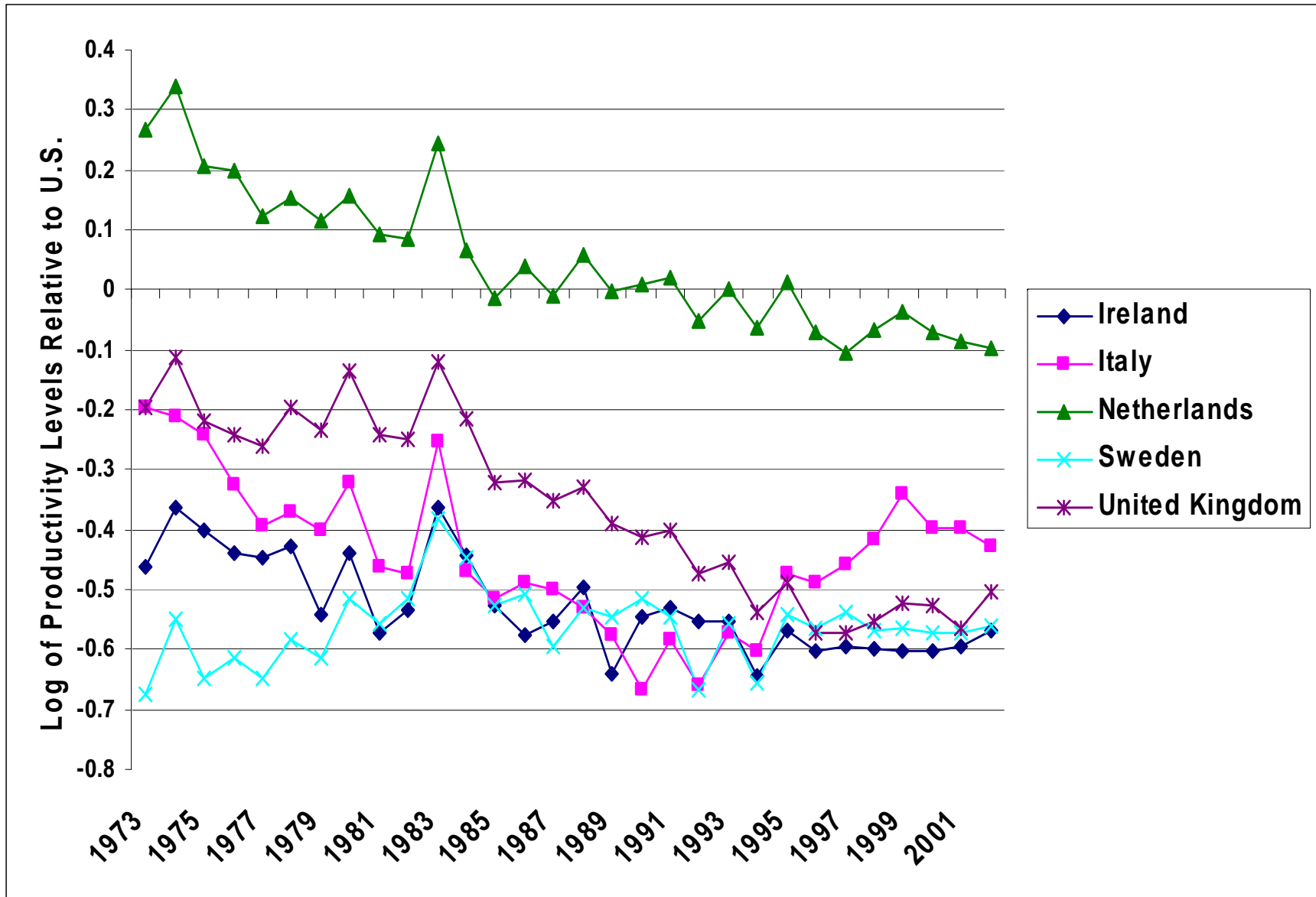
Relative Productivity Levels

• Turning to levels of productivity, we find that the Netherlands had the highest level of productivity relative to the United States in 1973 at 1.305, followed by Belgium at 1.187

• The United States had closed the gaps in relative levels of productivity by the early 1990s

• Sweden and Spain were the only European countries to achieve more rapid rates of growth of productivity than the United States

• Spain began the period in 1973 with the second lowest relative level of total factor productivity of any European country, but had overtaken Greece by 1977, Ireland by 1978, Italy by 1979, France by 1984, Germany and the United Kingdom by 1985, and Belgium and Denmark by 2002

- There are several likely explanations for Spain's performance

- The first is technological "catch-up" by initially backward countries

- Those countries that lagged furthest behind the technology leaders benefit the most from the diffusion of technical knowledge and, hence, exhibit the most rapid rates of productivity growth

- Another factor is capital deepening

- Among the eleven European countries, only Denmark, France, and Ireland had faster rates of growth of capital per unit of labor than did Spain

Trends of Relative Productivity Levels
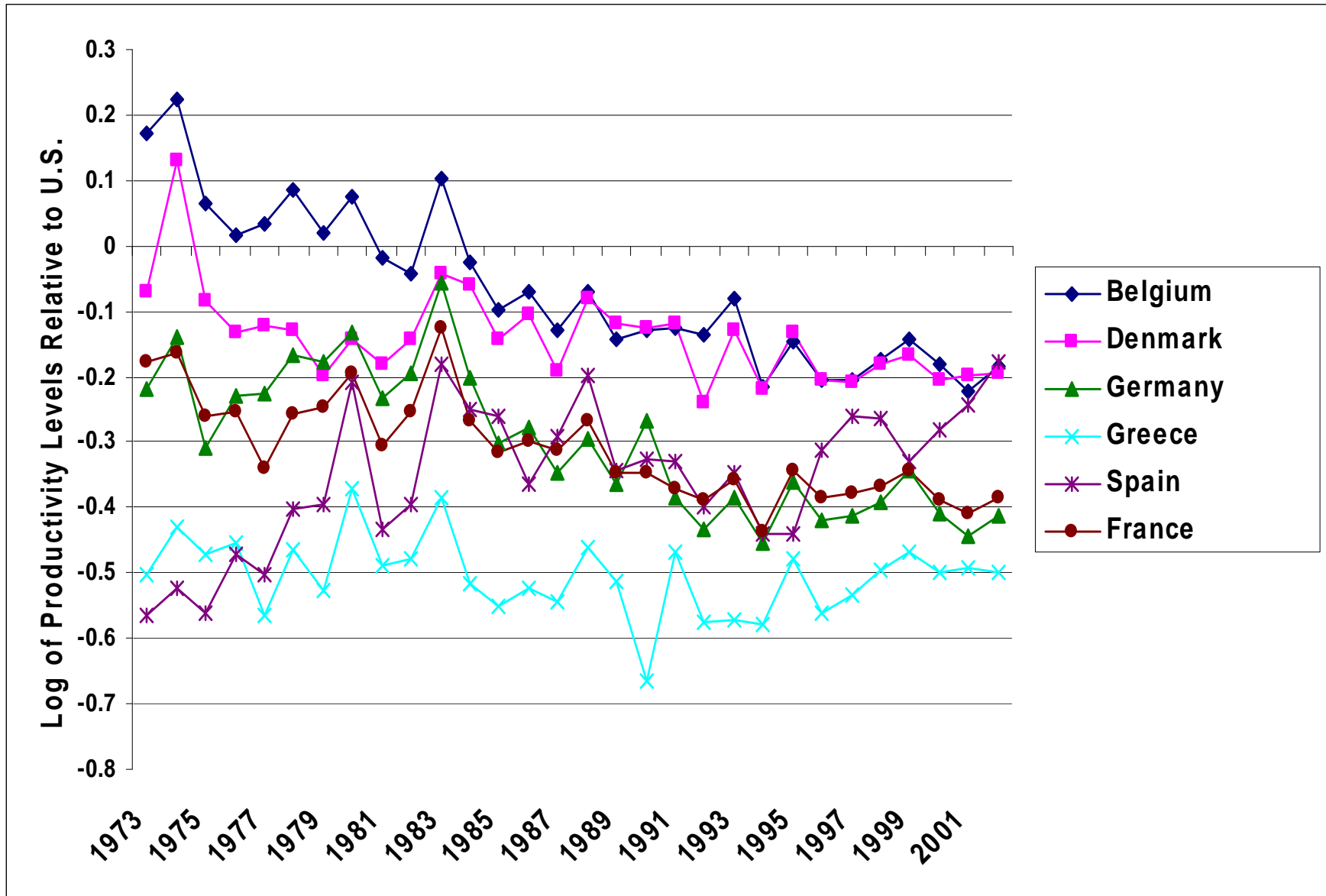
Trends of Relative Productivity Levels (Cont.)

International Competitiveness

• We can account for movements in relative prices of output by changes in relative input prices and changes in relative levels of productivity

• In the 1970s output prices in the European countries were above the United States price level, due primarily to lower levels of productivity

• Belgium and the Netherlands had higher levels of productivity than the United States in the 1970s, but these countries faced substantially higher capital and land input prices

• The international competitiveness of European agriculture improved during the early 1980s

• This was because of more rapid increases in the costs of capital and land inputs in the United States and the appreciation of the dollar

• Output prices in the European countries increased relative to the United States after 1985

• A weaker dollar during this period resulted in higher prices of materials, capital, and land inputs in the European countries

• Slower growth of productivity in the European countries further eroded their international competitiveness

• The upward trend in relative output prices was reversed after 1995, notwithstanding the increasing United States productivity advantage

• More rapid increases in the prices of capital and materials inputs and the appreciation of the dollar pushed prices in the United States higher

Summary and Conclusions

• This study looks at the international competitiveness of agriculture in the European Union and the United States

• Our measure of international competitiveness is the price of output in the Member States relative to that in the United States

• We assume that markets are competitive and in long-run equilibrium so that the observed price always equals average total cost

• This result is used in our decomposition of relative price movements into changes in relative input prices and changes in relative levels of productivity

- Our price comparisons indicate that the United States was more competitive than its European counterparts throughout the study period, except for the years 1973-74 and 1983-85

- Our results also suggest that the relative productivity level was the most important factor in determining international competitiveness

- Over time, however, changes in competitiveness were strongly influenced by variations in exchange rates through their impact on relative input prices

- During the period 1979-84 and 1995-2001 a strengthening dollar helped the European countries become more competitive, even as their productivity performance lagged