*Conference on Causes and Consequences of Global Agricultural Productivity Growth, Washington DC, May 11-12, 2010*

# GROWTH AND PRODUCTIVITY IN ARGENTINE AGRICULTURE

Daniel Lema

Instituto de Economía y Sociología

INTA - Argentina

# OUTLINE

1. Motivation
2. Growth of Argentine Agriculture
3. Crop Production and Input Use
4. Productivity and Sources of Growth
5. Final words

# Motivation

- In the last fifty years the availability of new technologies has allowed an important growth in argentine agricultural production.
- Grain production, cultivated area, and average yields increased sharply in the last twenty years.

# Motivation

- A relevant question is if land productivity growth was associated with positive shifts in the production function
- During the last 20 years Argentina has increased the use of fertilizers, improved seeds, machinery and human capital.

# Growth of Argentine Agriculture

- From 1860 to 1930 the economic growth of Argentina was mainly based on the exploitation of land of the Pampas.
- Agricultural production and GDP grew at very high rates.
- After the 1929 Crash, Argentina gradually transformed itself from a very open economy into one of the most closed economies in the world

# Growth of Argentine Agriculture

- World trade started to be gradually liberalized after 1945 but Argentina decided to maintain trade barriers.
- Economic performance began to deteriorate, particularly in agriculture, and economic growth slowed down.
- In this context argentine agriculture started a period of stagnation.

# Growth of Argentine Agriculture

- The cultivated area and grain production fall along the 1940s
- In 1952 the wheat production was lower than the domestic consumption.
- Starting from then the policies changed slowly and began to reconsider the role of the agriculture in the Argentine economy.

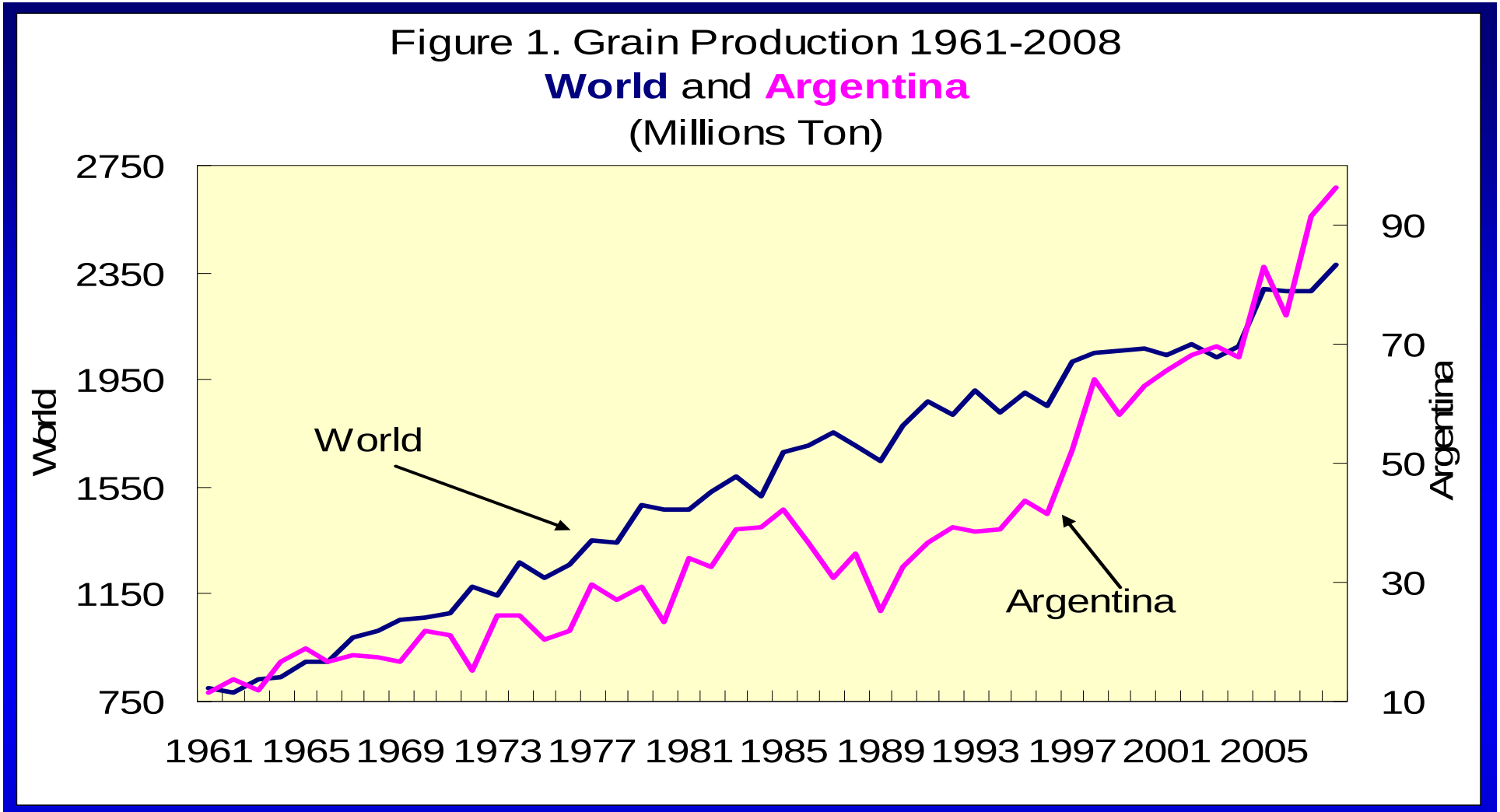
# Growth of Argentine Agriculture

- A recovery began in the 1970s, mainly due on account of the promotion of mechanization and adoption of improved seeds
- The more market oriented policies after 1990 led the agricultural sector to a new growth process doubling the grain production between 1990 and 2005.

# Crop Production and Input Use

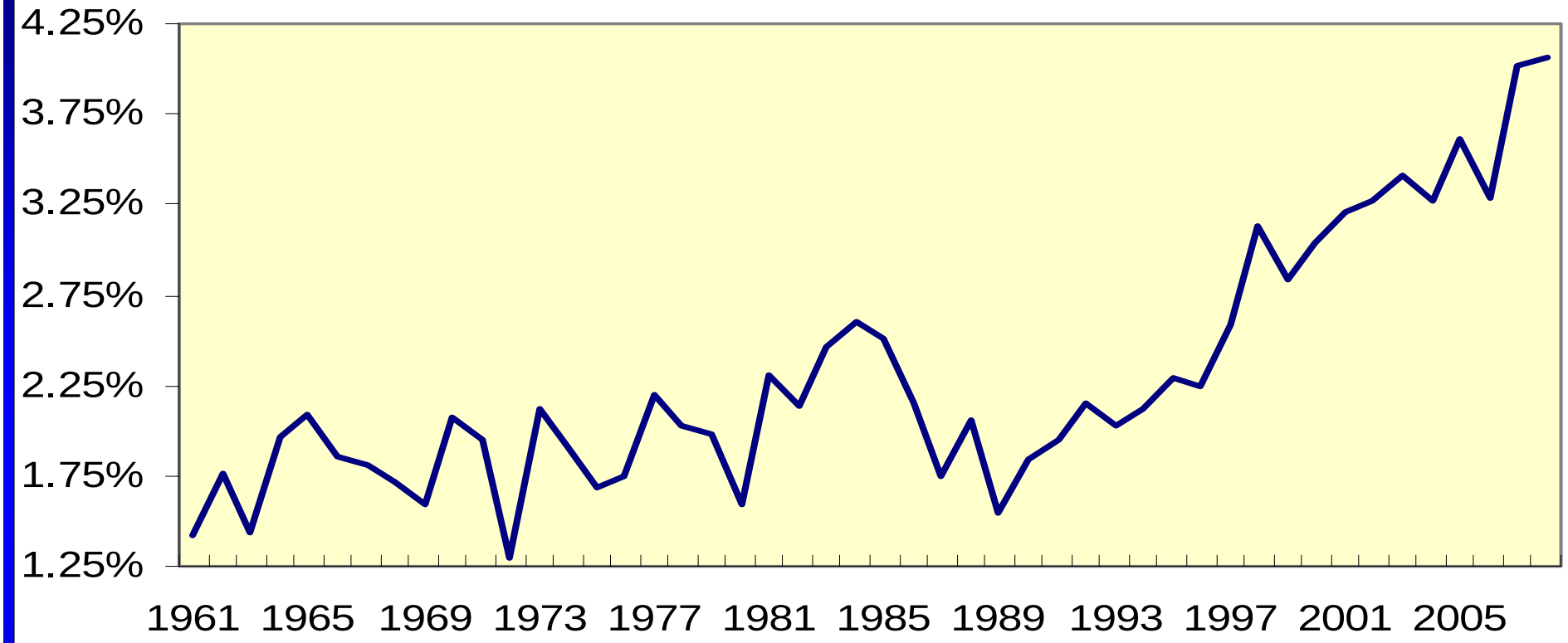
- The growth rate of grain production in Argentina between 1995 and 2008 was 6.6%.
- As a comparison, during the period of the great expansion of the Argentinean agriculture, between 1900 and 1914 the growth rate of grain production was 4.6%.

- From 1961 to 1994 cultivated area grew from 9.5 to 16 million of hectares (78%).
- The area expanded other 13 million of hectares (81%) between 1994 and 2008.
- This increase recognizes three main sources:
- Around 50% has replaced pasture land
- 25% is due to a more intensive use of the soil (double cropping wheat-soybeans)
- 25% is due to the expansion of the soybeans outside of the Pampean region



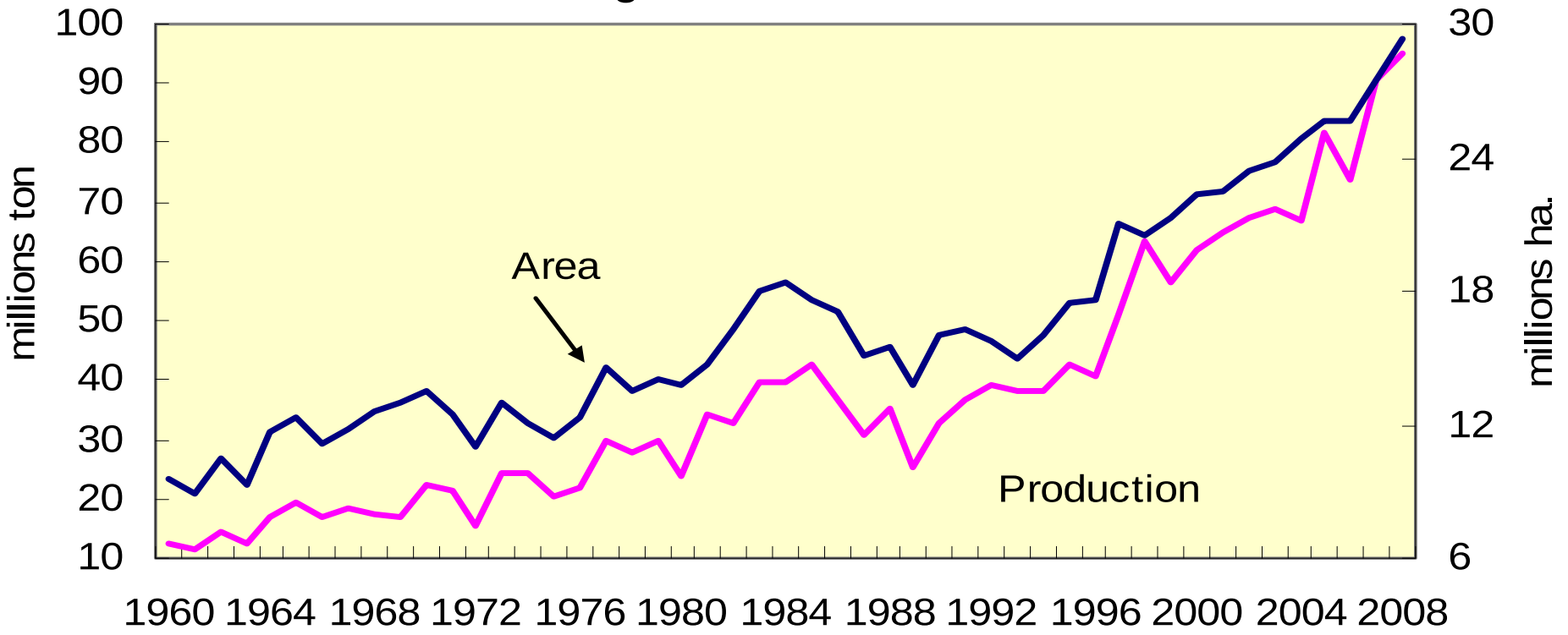

Grain production grew along the last half century at an annual rate of 4%. This rate was higher than the world rate (2.3%).

Figure 2. Argentina
Share of world grain production 1961-2008



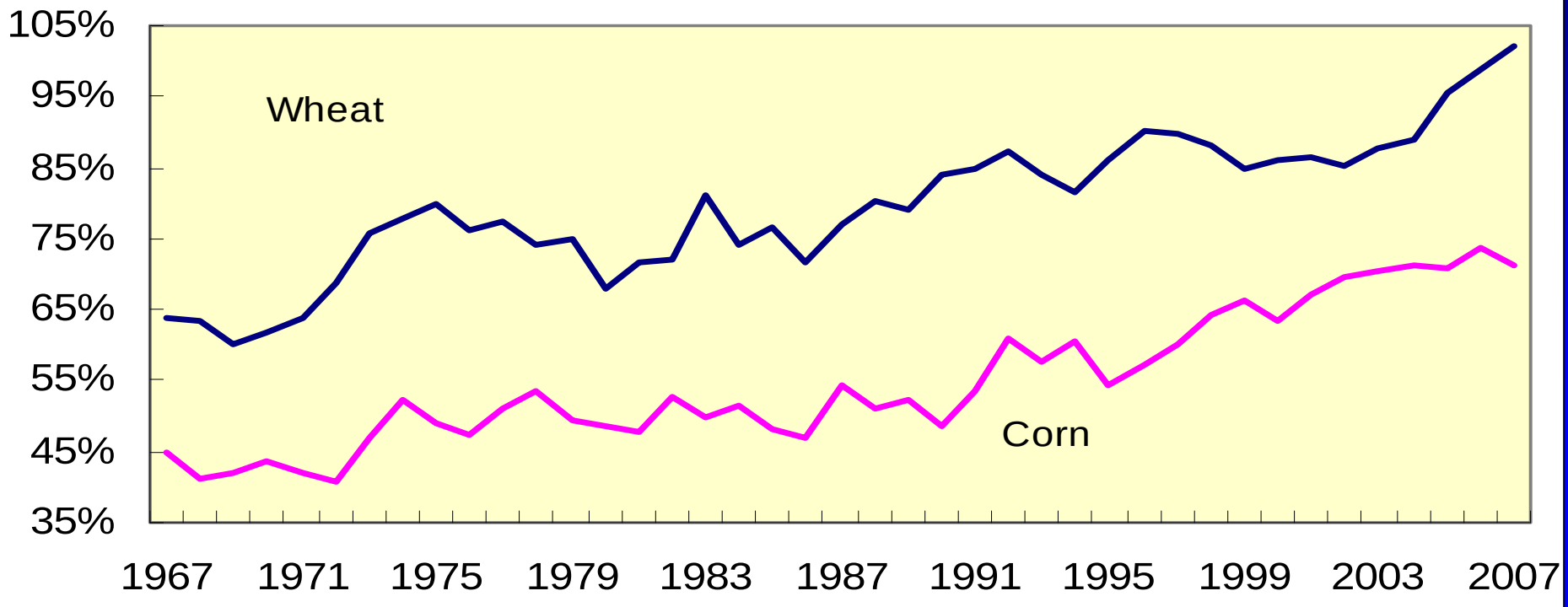

The Argentine share in world grain production in the last 50 years multiplied by four: it reaches 4.25% in 2008.

Figure 3. **Area** and **Grain Production**
Argentina 1960-2008




The area grew 3 times (10 to 30 millions of hectares), the production multiplied by 8 (12 to 95 million tons) and the average yield per hectare grew from 1.3 to 3.2 tons.

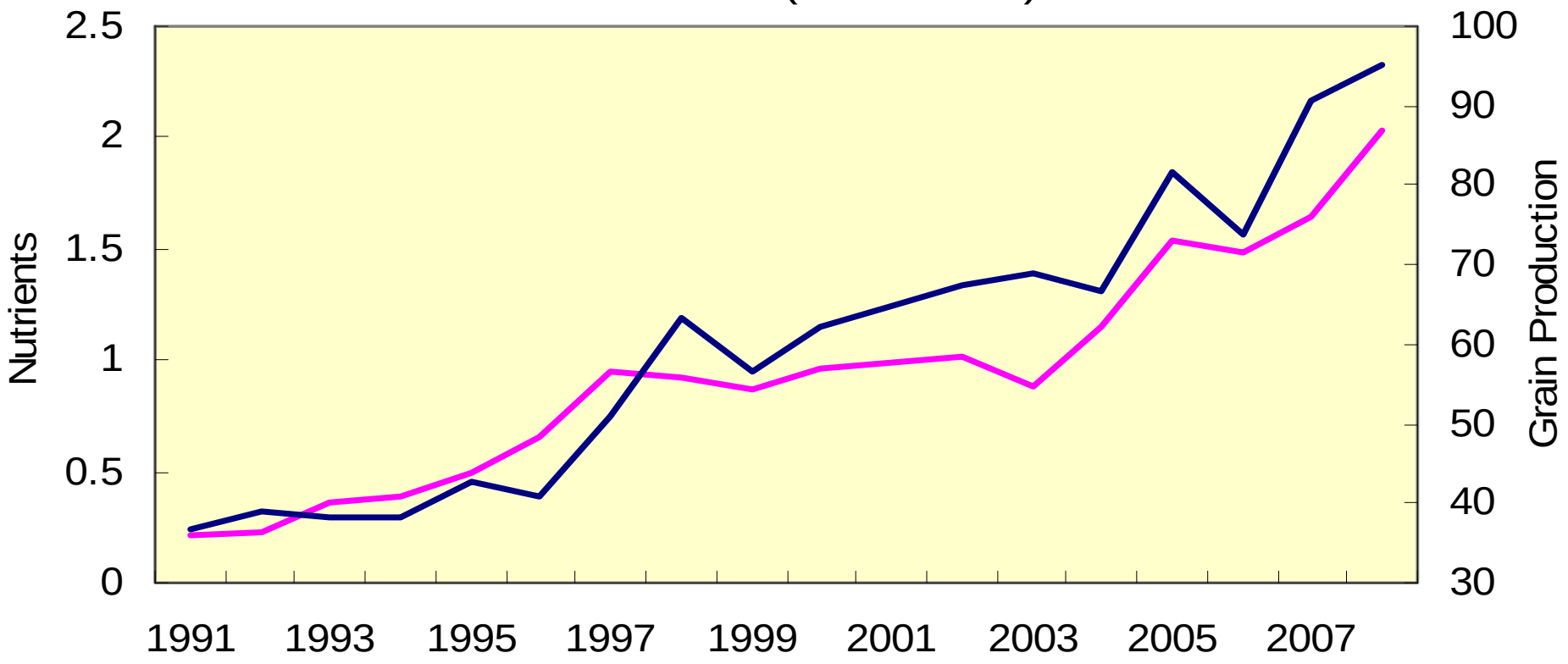
Figure 4. Relative **Wheat** and **Corn** Yields - Argentina/US
1967-2008




In the 1960s corn and wheat yields in Argentina were, on average, 50% of those reached in the US.

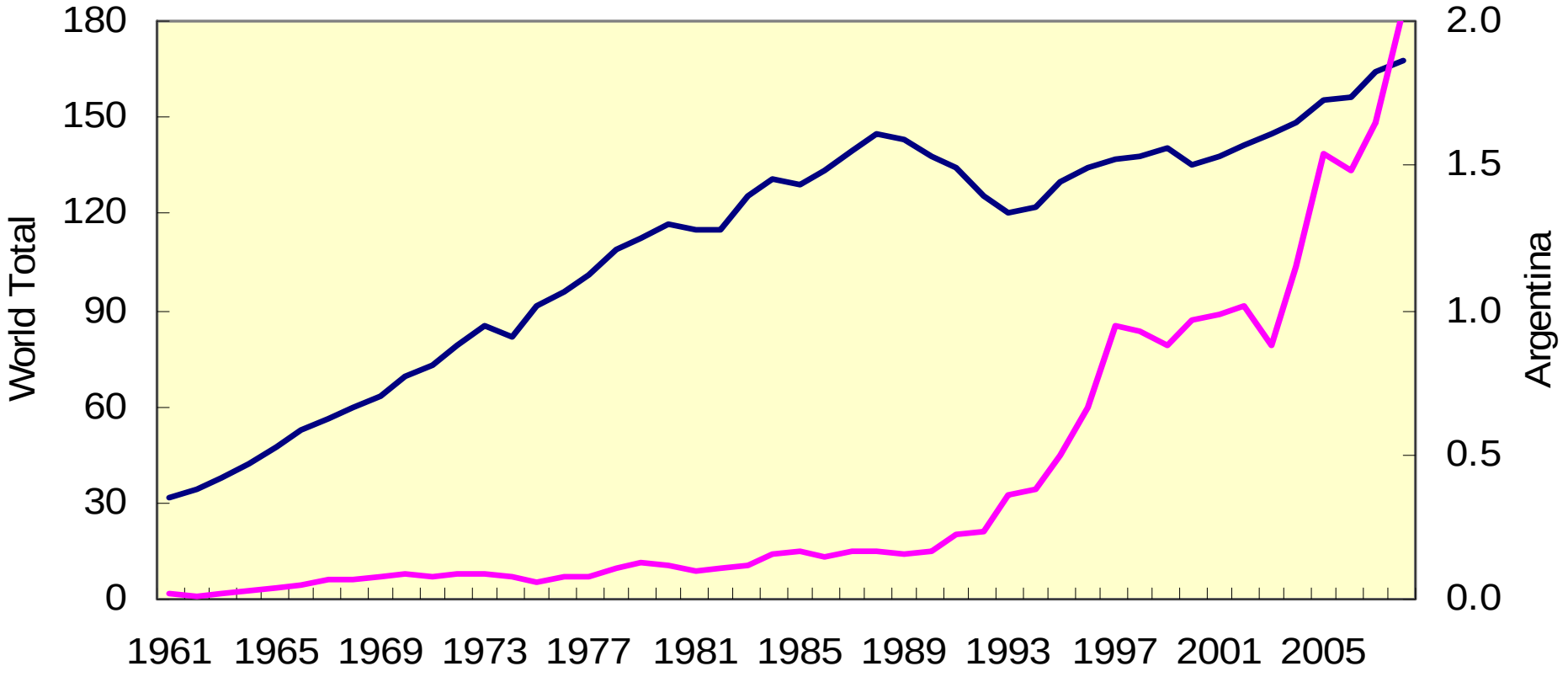
Since 1970 the gap began to decrease

Figure 9. Argentina: **Grain Production** and **Fertilizers Use**
1991-2008 (millon tons)




Fertilizers have been one important input in the growth of the grain production between 1990 and 2008.

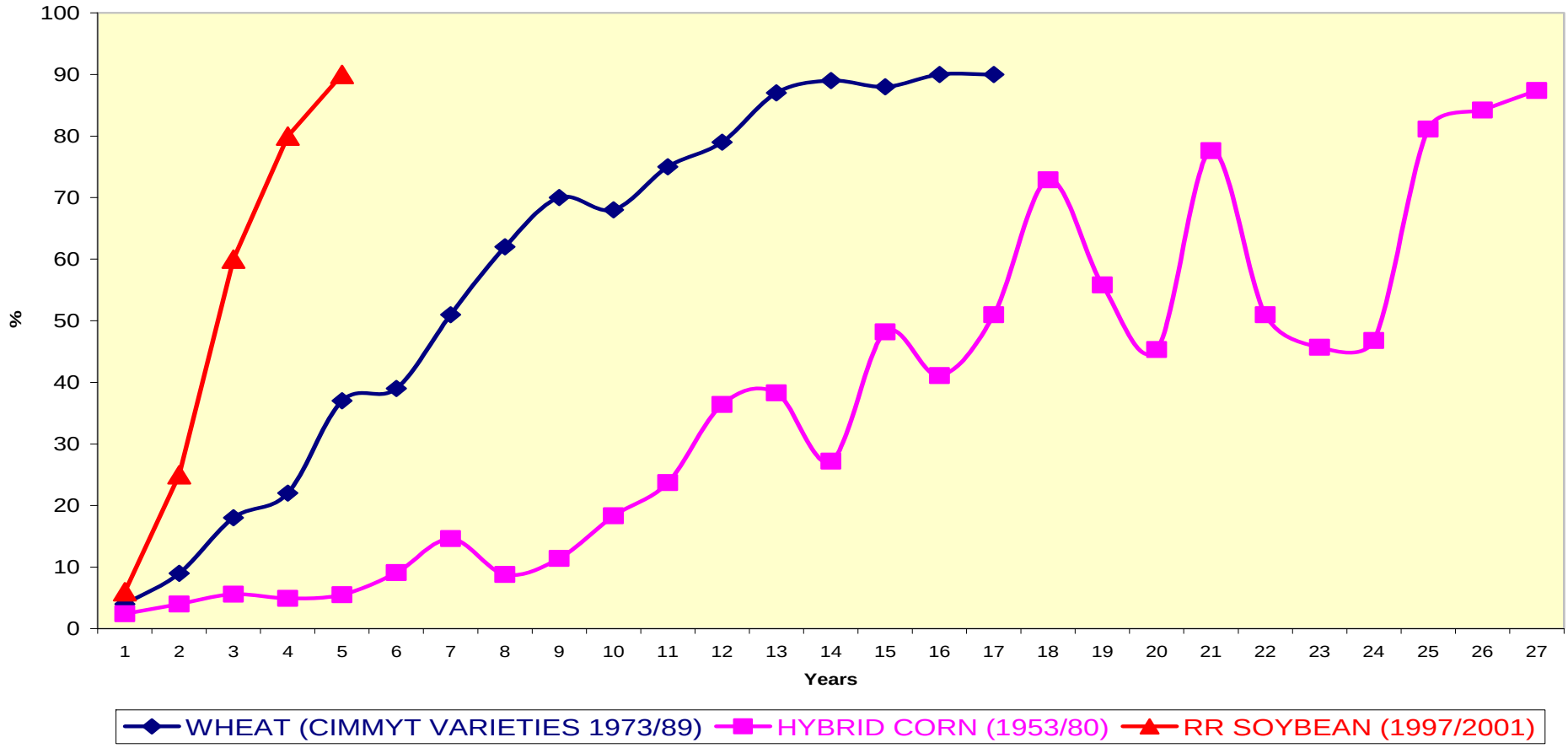
Figure 8. Fertilizers Use - **World** and **Argentina** (million tons)
1961-2008




Between 1991 and 2008 the use of fertilizers in Argentina grew 8 times.

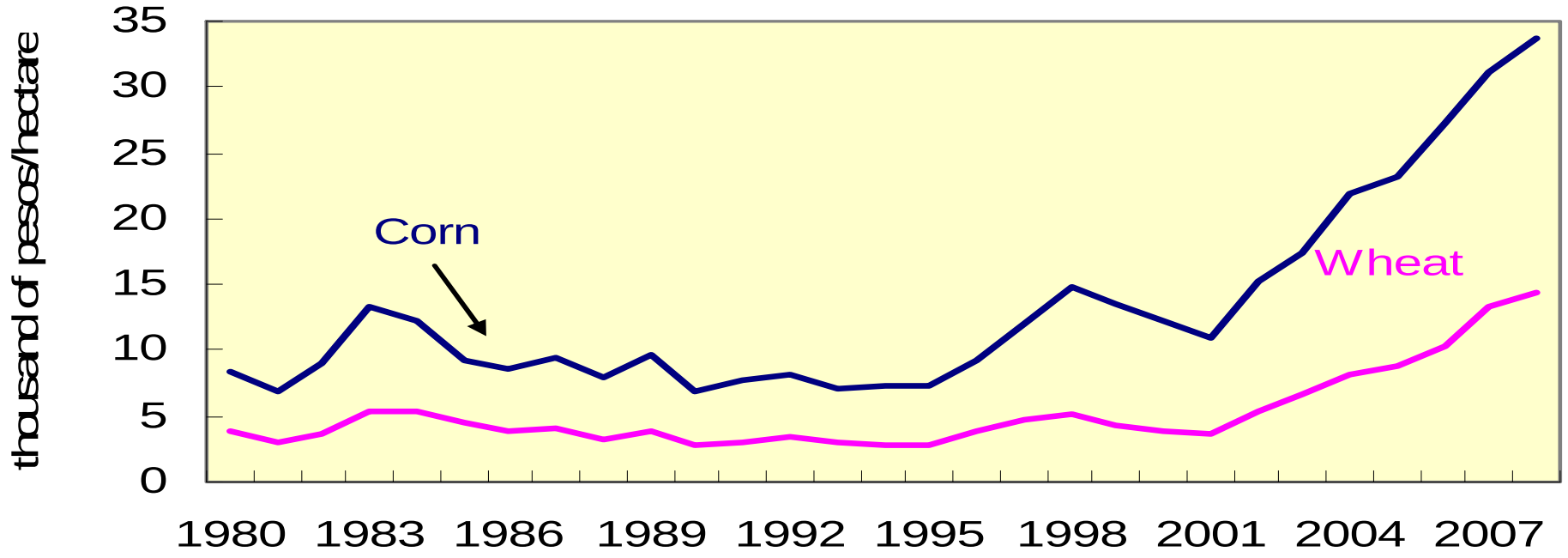
Similar to what happened in the main grain producers after World War II

Figure 10 Argentina: Adoption of new seeds
(% of the total crop area)



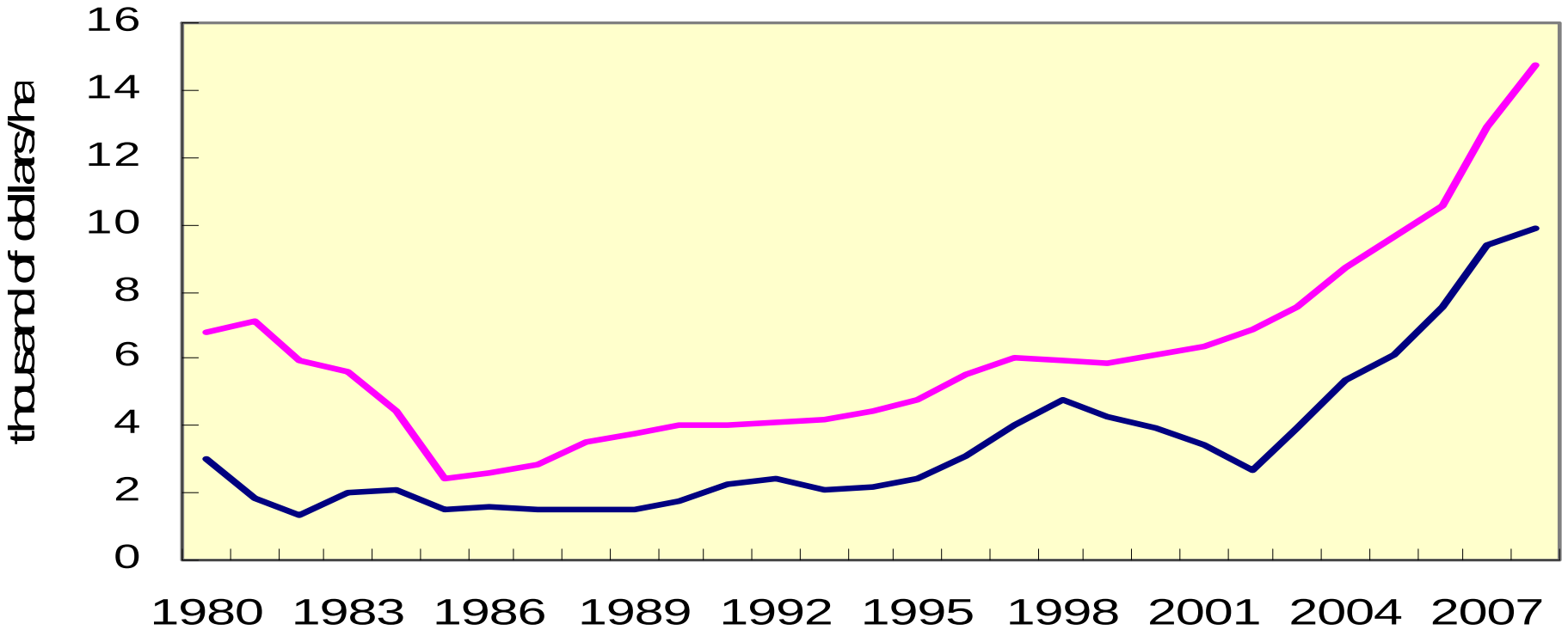

The rapid adoption RR soybean varieties become the most important genetic breakthrough in the agriculture over the last years.

Figure 6. Land prices (Pampean Region)
1980-2007




The land prices captured the combined effect of the rise in grain prices and the growing agricultural productivity

Figure 7. Land Prices - Argentina and Iowa
1980-2008




Land prices in Argentina were 40% below to those of Iowa in the 1970s, 20% in the 1980s and 15% in the last years

# PRODUCTIVITY ESTIMATES 1968-2008

- **TOTAL FACTOR PRODUCTIVITY**
- **TFP = Y/X**
- **GROWTH APPROACH**
- **Growth rate of TFP: growth rate of the product (Y) minus the growth rate of inputs (X)**
- **THEORETICAL ASSUMPTIONS**
  *** Hicks neutral technological change.**
  *** Linear homogeneity of the production function**
  *** Profit Maximization**

**Output Index**

- **Value of Grain Production (Wheat, Corn, Sunflower and Soybeans)**

**Input Index: Quantities**

- **Land (hectares)**
- **Labor (economically active persons)**
- **Capital (tractors and harvesters)**
- **Fertilizers (tons)**
- **Constant Input Shares** (from previous estimates)
- **Land 0.33**
- **Labor 0.33**
- **Capital 0.31**
- **Fertilizers 0.03**

Table 1. Output, Inputs and TFP - Annual growth rates (%)

| Years | Output | Land | Labor | Capital | Fertilizers | **TFP** |
|---|---|---|---|---|---|---|
| 1968-08 | 5.24 | 3.18 | 0.03 | 1.09 | 8.34 | 2.43 |

Figure 12. **Production** and **Land** Indexes 1968-2008
1968=100

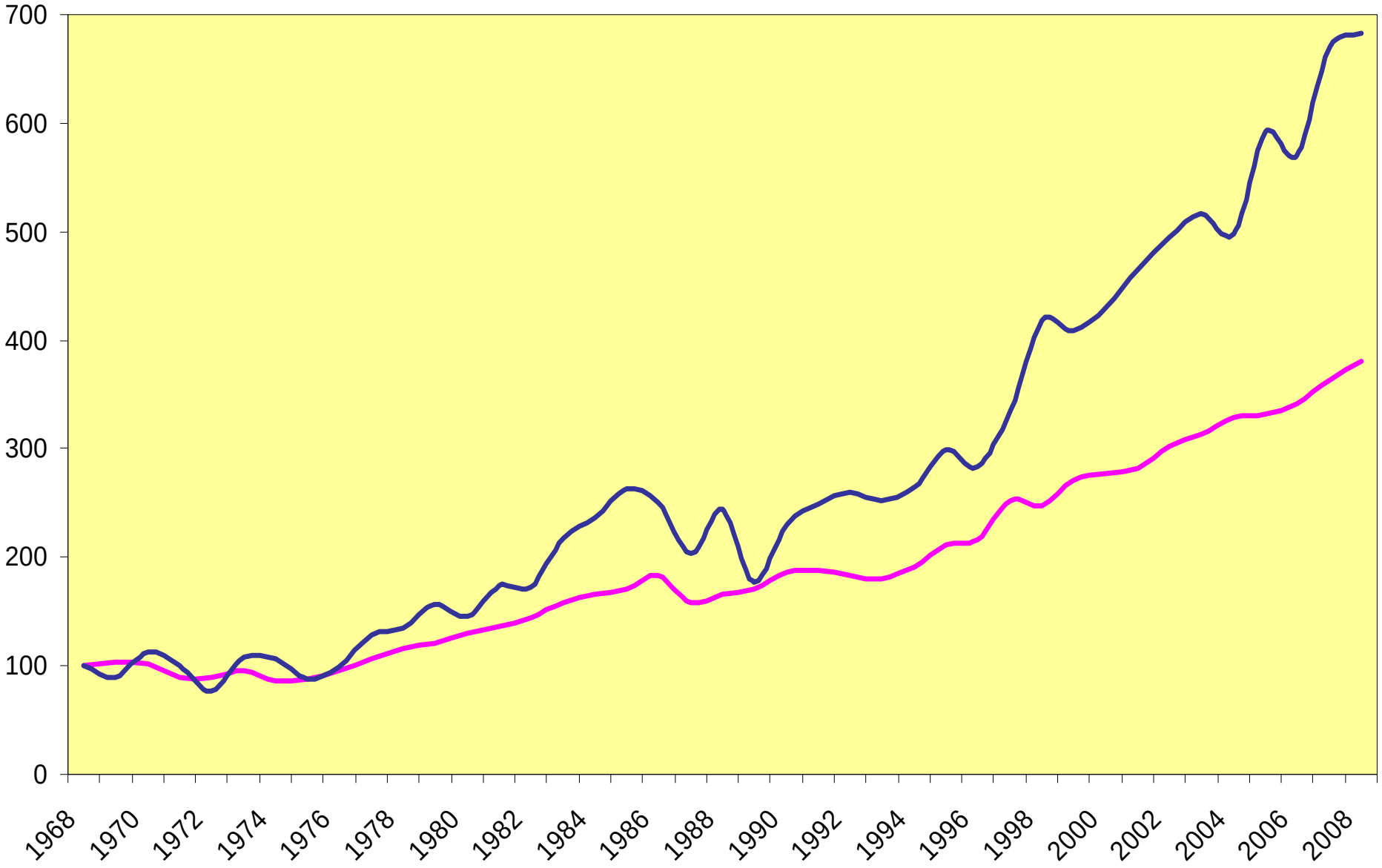
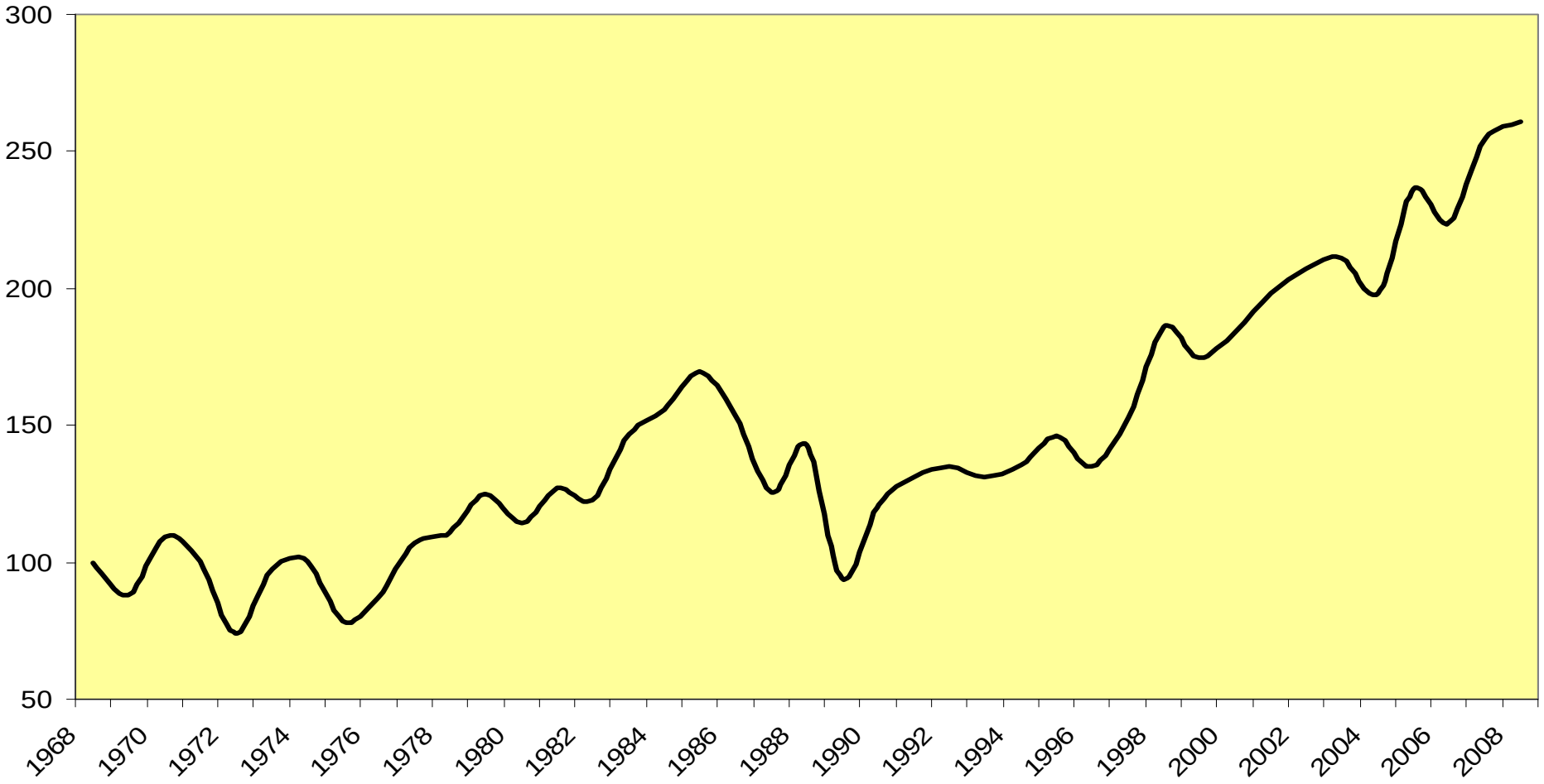
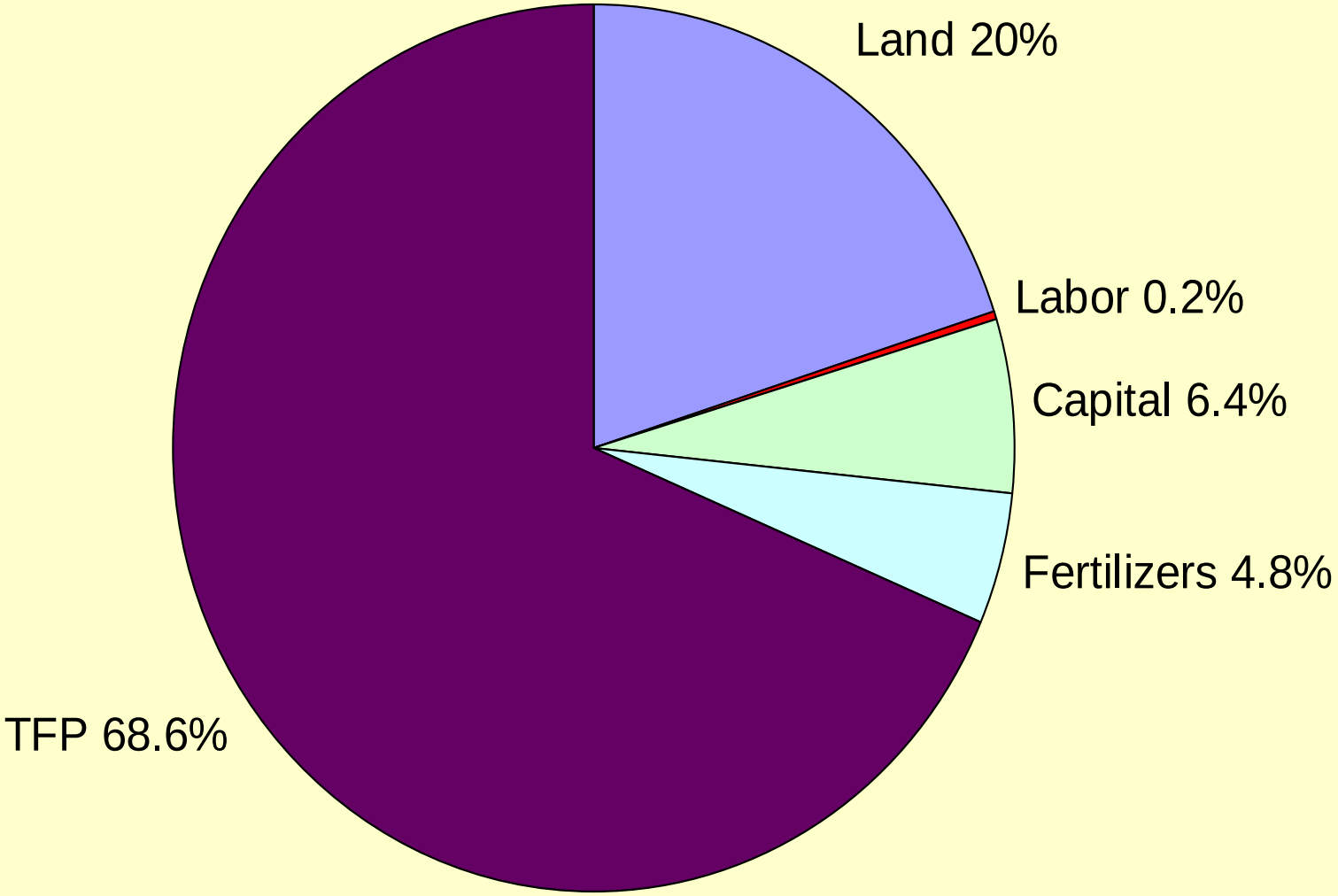


Figure 14. Argentine Agriculture TFP Index 1968-2008
1968=100




1990-2008 TFP growth rate: 4.38%.

Figure 15. Argentina - Sources of Agricultural Growth
1968-2008



# Final Comments

- TFP growth rate summarizes a group of improvements that are not captured by the input index.
- There have been important improvements in the quality of factors: better machineries and chemicals, new agricultural techniques and improvements in the quality of the human capital applied to agriculture.
- At the same time, these factors were combined with new organizational and managerial technologies that have allowed a great improvement in technical and economic efficiency.

# Final Comments

- The main result is the important role of technological change
- TFP explains more than two thirds of the output growth.
- This result suggests that the main contribution to output growth comes from the availability of innovations and the adoption of new technologies when the economic incentives are present.

# Final Comments

Topics for future research

- Output and input use in Cattle raising
- More and better data: Capital, Materials, Human Capital, Seeds.
- More data
- More data

- Thank you very much!