II. MACRO- AND STRUCTURAL CHANGES IN THE EUROPEAN ECONOMY, ca. 1290 - 1520

A. The Dynamics of Population Changes in Western Europe, ca. 1000 CE – ca. 1500 CE

1.	**11 September 2013** **Epstein**, ch. 6 **Brady**, ch. 5 (Munro), ch. 16 (Mallett); **Cipolla**, chs. 8, 3; **Musgrave,** ch. 1 **ET 1**	**2**	**MACRO-ECONOMIC CHANGES: POPULATION:** **Demography** and European Economic Development; Population Growth and the Law of Diminishing Returns.

Demography and Macro-Economics

- (1) **Robert Lopez:** 'Population and Prices are the twin pillars of economic history'
- (2) **Our examination of macro-economic changes** in both semesters necessarily involves three components:
- **POPULATION,**
- **MONEY, AND**
- **PRICES**

Prices in Medieval Europe

- (3) **Price Changes: in terms of**
- a) **monetary factors**: stocks and flows of money on the form of coin and also credit
- b) **real factors**: demography, technology, overseas explorations, settlements, etc.
- (4) **Distinction between NOMINAL and REAL PRICES or RELATIVE PRICES**: i.e., the price of one good relative to prices of other good

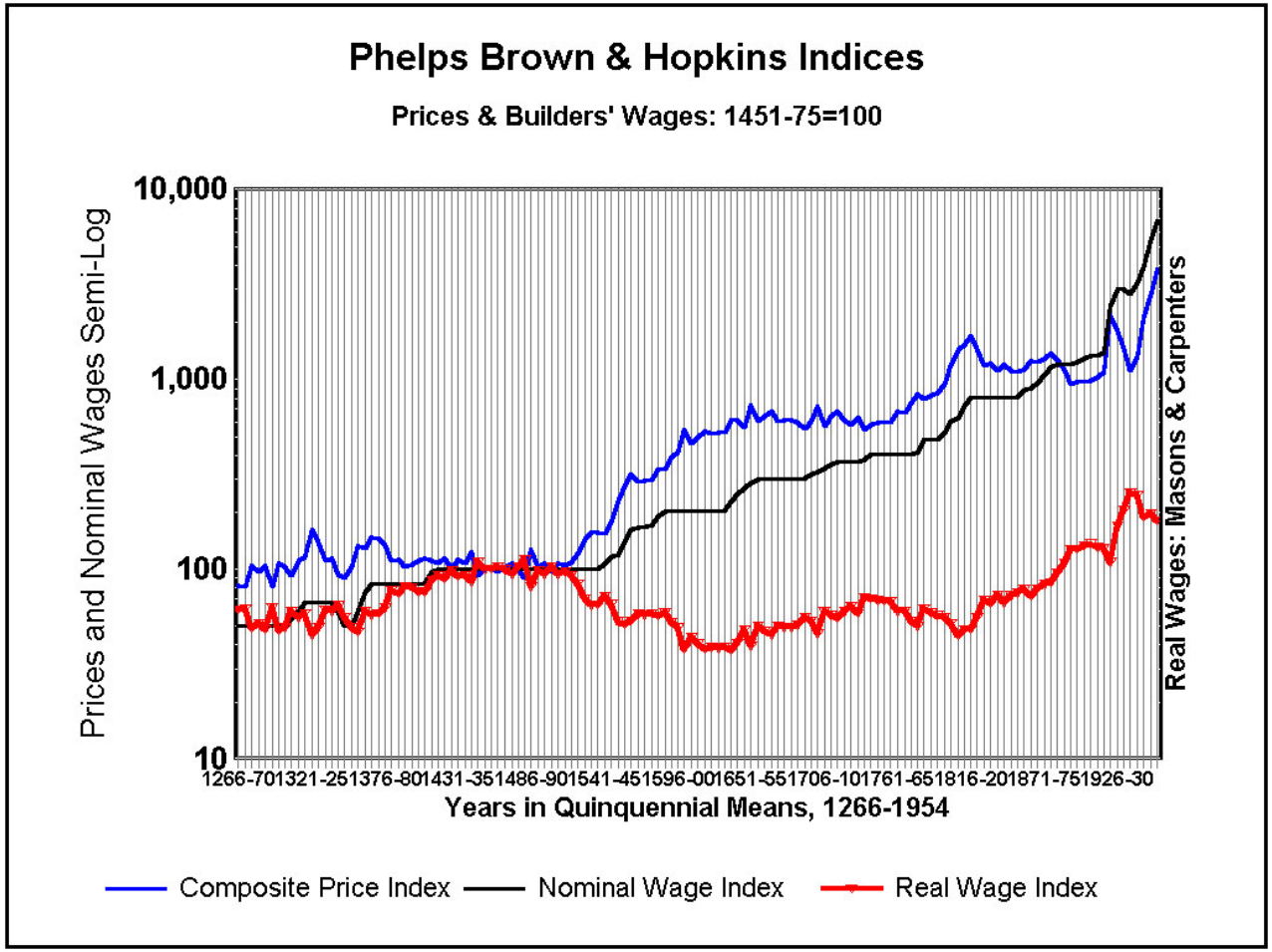
Prices: Nominal and Real 1

- (1) **Nominal Prices and the Price Level**
- a) **prices indicated in nominal money of account:** in modern terms: in current dollars (or pounds)
- b) **prices measured in terms of the Consumer Price Index,** in index numbers**:** Composite Price Index
- (here: with a base period of 1451-75 = 100)
- c) **Movement of Nominal Prices and Nominal Wages**: in terms of **INFLATION & DEFLATION**, also expressed in index numbers

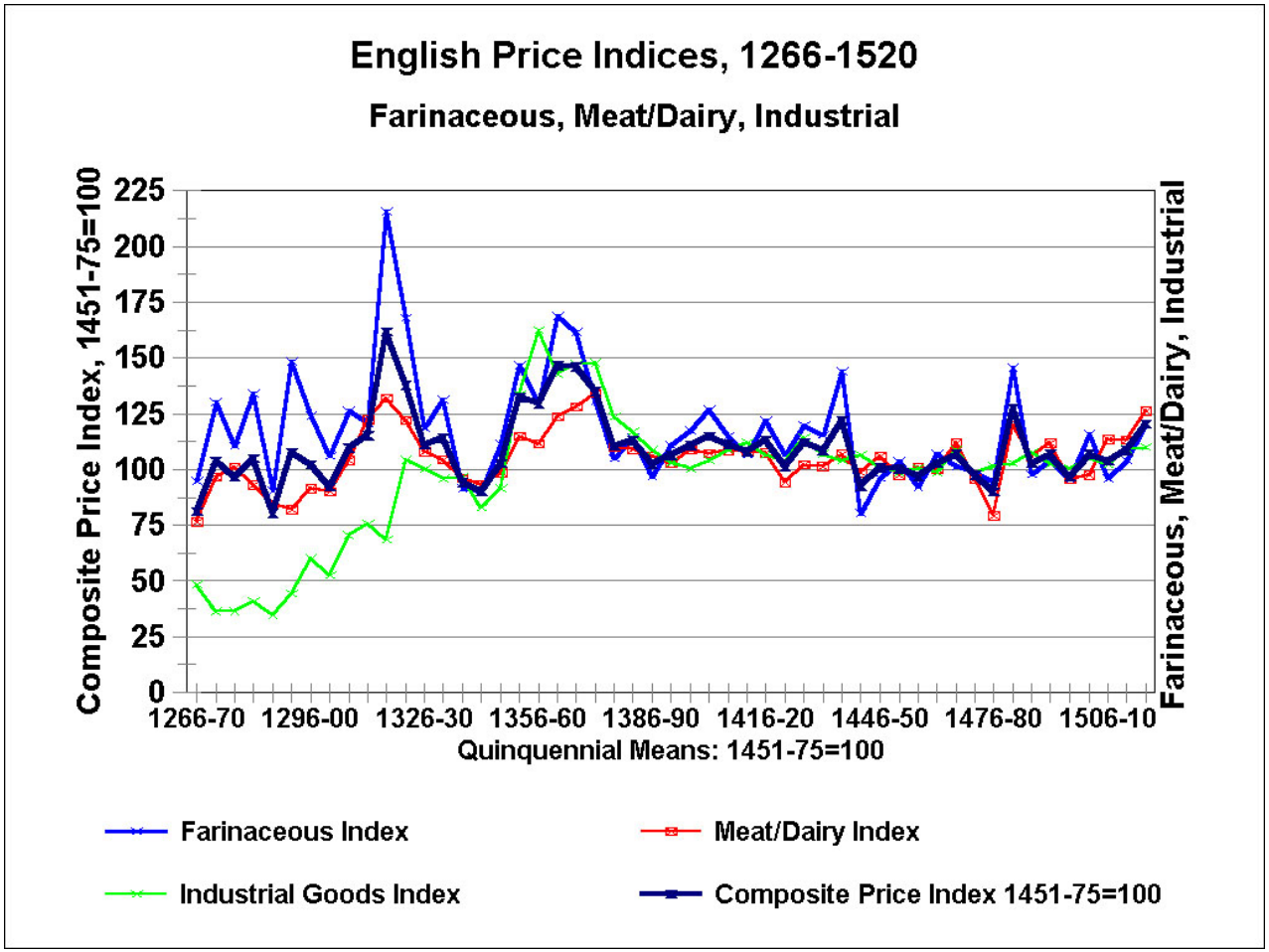
Prices: Nominal and Real 2

- (2) **Real or Relative Prices and Wages**
- (a) **REAL PRICES**: **price changes of Good X (wheat)** relative to changes in the price of **Good Y (bricks)**:
- b) **or relative to changes in the CPI** → deflated prices
- c) **REAL WAGES**: Nominal Wage Index divided by the Consumer Price Index:
- **RWI = NWI/CPI**, expressing what the nominal money wage in silver would buy in good & services

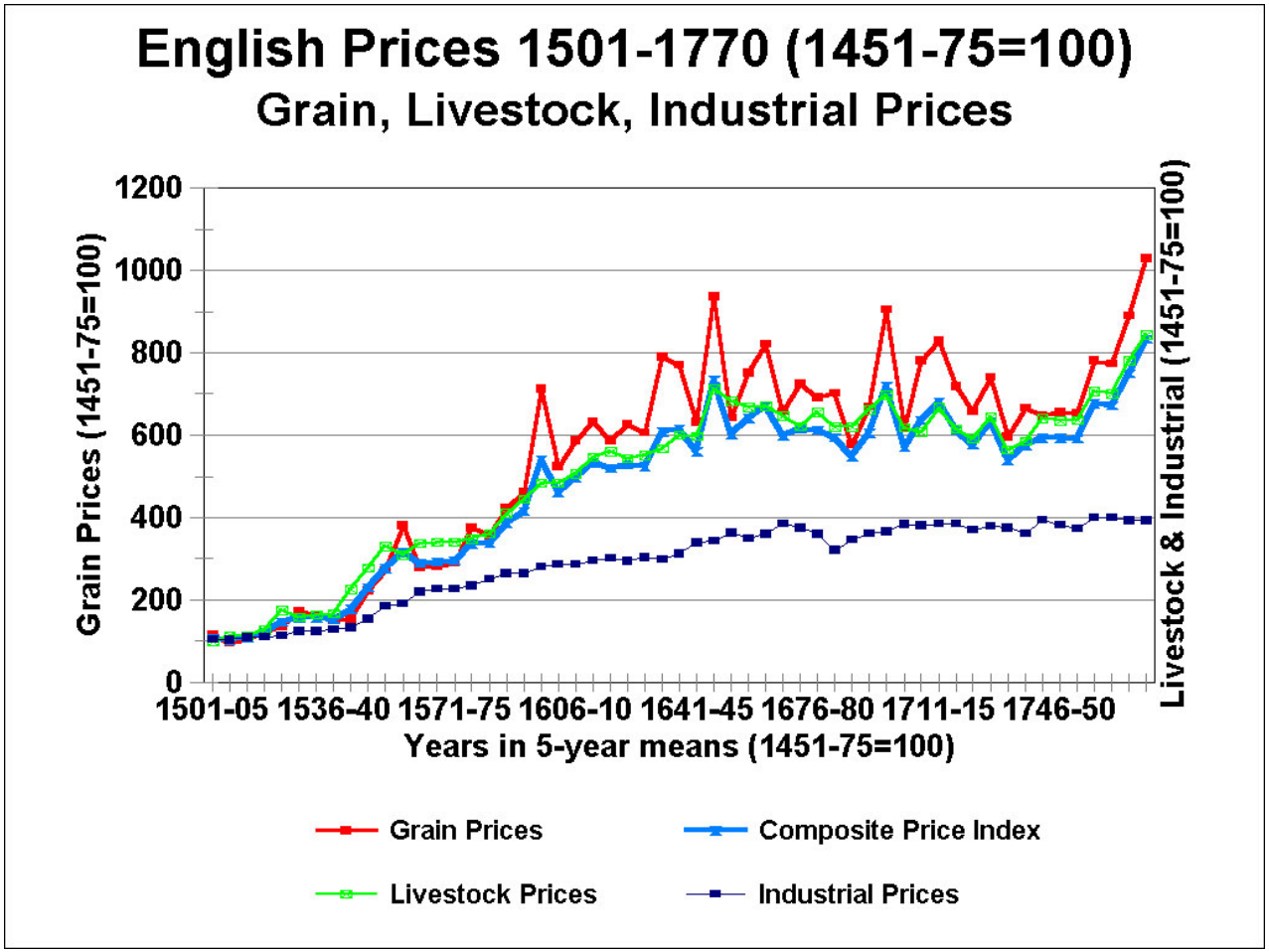
The Phelps Brown CPI and Real Wages in England, 1264-1954



English Price Indexes: 1266-1520



English Prices: 1501 - 1770



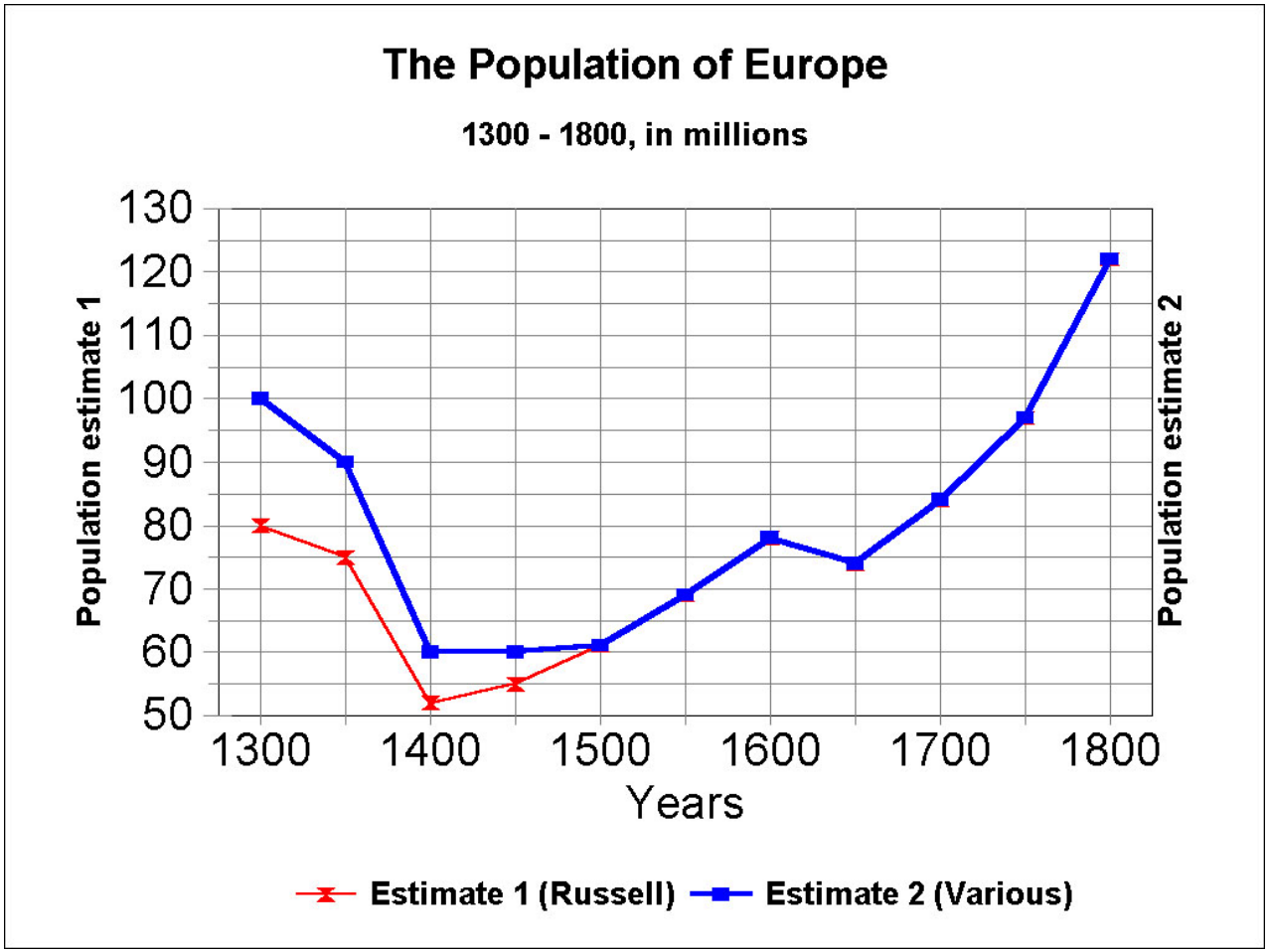
Changing Population of Medieval and Early Modern Europe

- **What do we know about levels of population and change in population** in medieval and early modern Europe?
- **Before 1600**, we can deal only with estimates
- **The following are the best that we have**
- **We next want to relate these changes in population** to changes in the price levels, and to changes in economic growth (or contraction)

Population Movements in Europe, 1000 - 1800

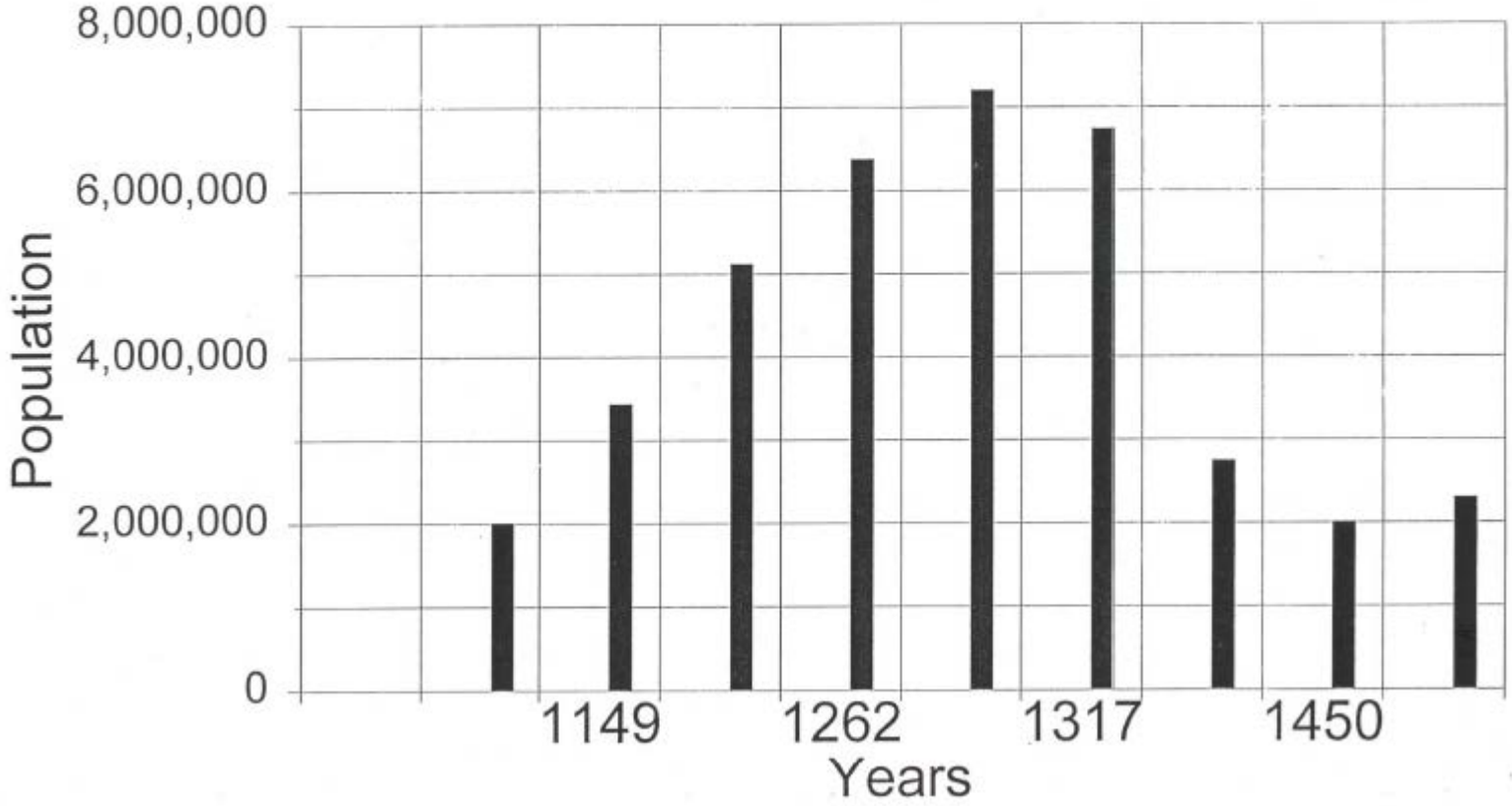
Year	Population in Millions
1000	40 million
1150	60 – 70
1300	80 - 100
1350	75 – 90
1400	52 – 60
1450	50
1500	61
1550	69
1600	78
1650	74
1700	84
1750	97
1800	122

Population Graph: 1300 - 1800

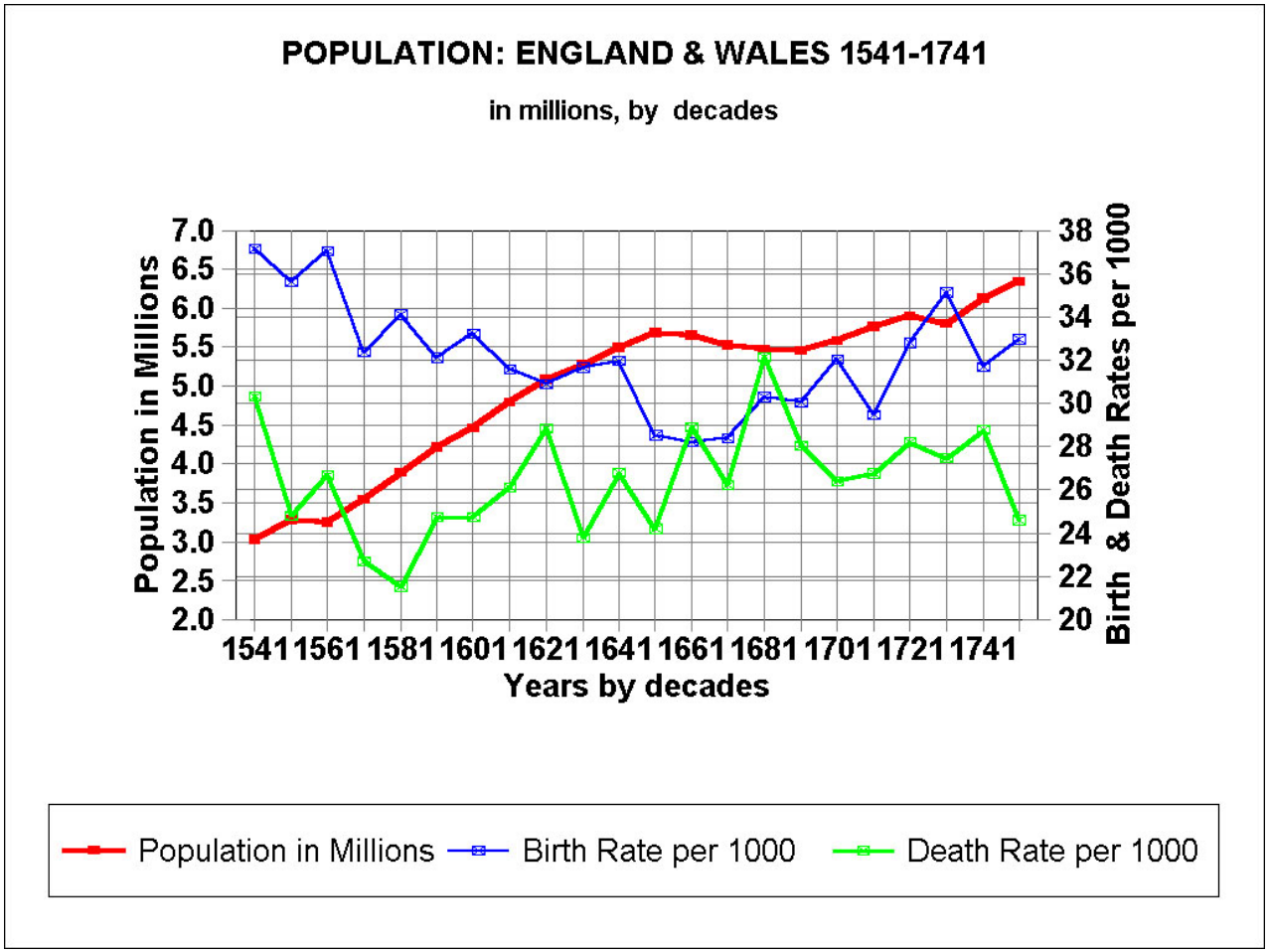


ENGLISH POPULATION ESTIMATES

1088 - 1523: in Millions



England's Population 1541 - 1741



MAJOR ECONOMIC & DEMOGRAPHIC TRENDS

A. THE MEDIEVAL 'COMMERCIAL REVOLUTION' ERA: RAPID POPULATION GROWTH:

ca. 1100 - ca. 1320 (Phase A)

B. LATE MEDIEVAL 'GREAT DEPRESSION': DEMOGRAPHIC CATASTROPHE

ca. 1320 - ca. 1460 (strong Phase B)

C. ECONOMIC AND DEMOGRAPHIC RECOVERIES

ca. 1460 - ca. 1520 (mild Phase A)

D. THE 'PRICE REVOLUTION' ERA: STRONG DEMOGRAPHIC GROWTH

ca. 1520 - ca. 1640 (strong Phase A)

E. THE 'GENERAL CRISIS' ERA of the 17th Century: DEMOGRAPHIC DECLINE OR STAGNATION

ca. 1640 [or 1620] - ca. 1740 (mild phase B)

F. THE INDUSTRIAL AND DEMOGRAPHIC ('VITAL') REVOLUTIONS

ca. 1740 - ca. 1820 (strong Phase A)

Demography & the Economy 1

- **Population Growth or Decline affects both:**
- a) **aggregate demand**: in terms of total factor incomes in society – but that depends on
- i) **percentage of adult population with means of payment:** for monetized aggregate demand
- ii) **age structure** (pyramid) of the population: ratio between producers (adults) and consumers
- b) **aggregate supply**: in terms of the factors of production, three of which grow or contract with population changes

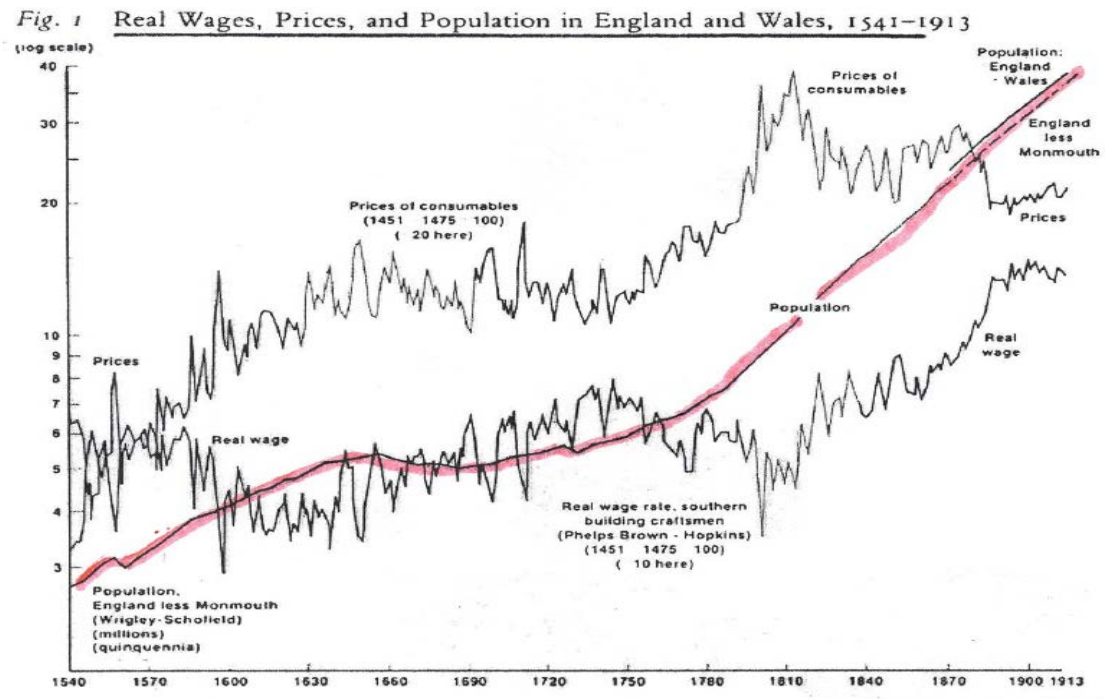
Demography and the Economy 2

- **The Fundamental Questions to be asked:**
- 1) **What were the causes of population growth?**
- a) **as the consequence of economic growth?**
- -- thus **endogenous** factors: built into the economy
- b) or: **consequences of independent variables**, especially biological: e.g., pathogens & diseases, as **exogenous** factors

Demography & the Economy 3

- 2) **What were the consequences of population growth**: **positive or negative**?
- a) **was economic growth itself generally the positive consequence of population growth**?
- b) **or did population growth (at times) lead to subsistence crises,** economic crises, and demographic crises?
- c) **For subsistence crises,** we must now turn to the famous **Law of Diminishing Returns**, in terms of the basic factors of production (as follows).

Population, Wages, Prices in England, 1541 – 1913 (Lindert)
RWI = NWI/CPI



Factors of Production, Diminishing Returns, and Population

Factor of Production	Factor Cost or Factor Income
LAND	RENT
LABOUR	WAGES
CAPITAL	INTEREST
ENTERPRISE SUM (∑) OF FACTORS	PROFIT = TOTAL COSTS = TOTAL INCOME = NNI

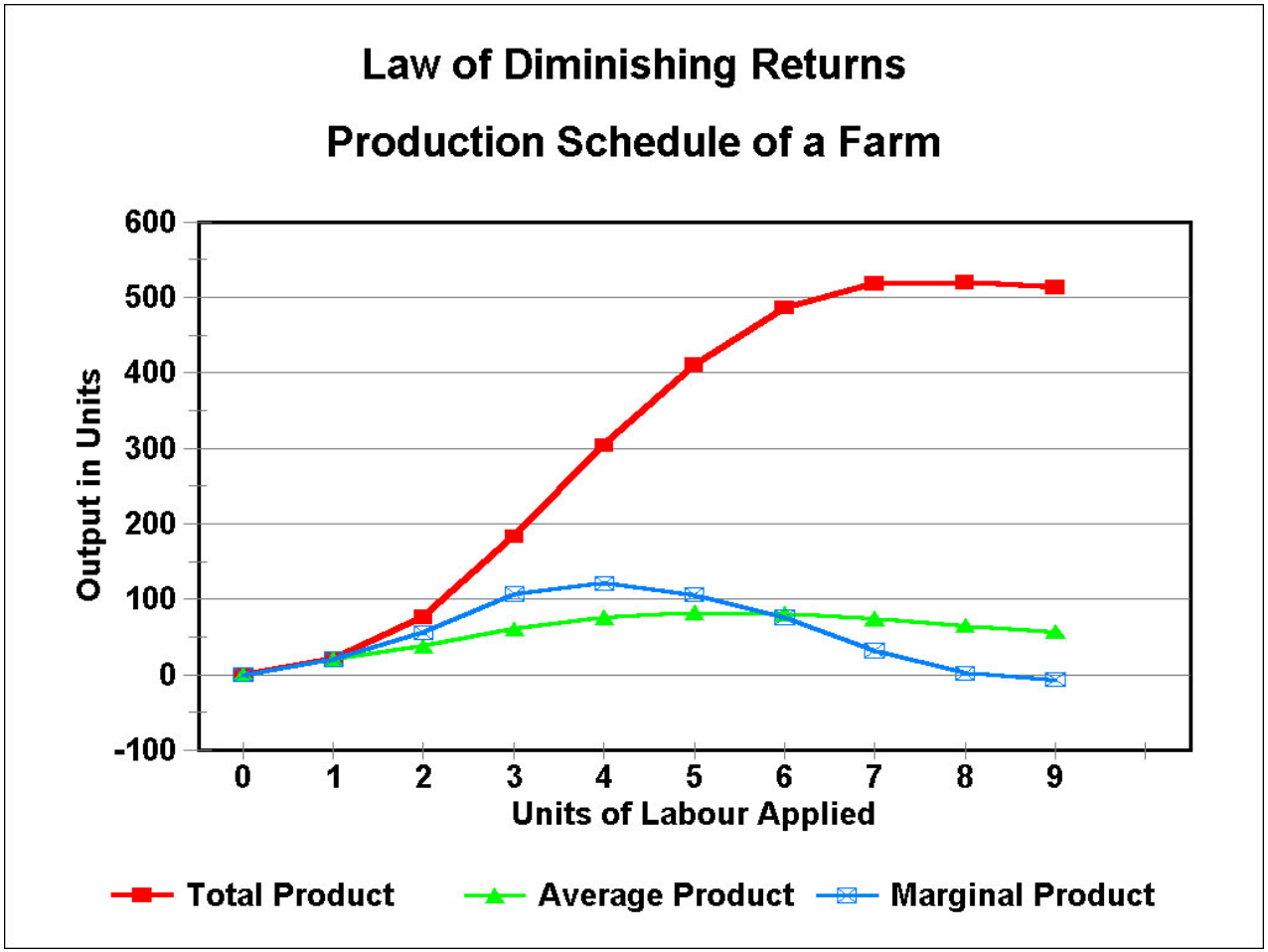
THE LAW OF (EVENTUALLY) DIMINISHING RETURNS:

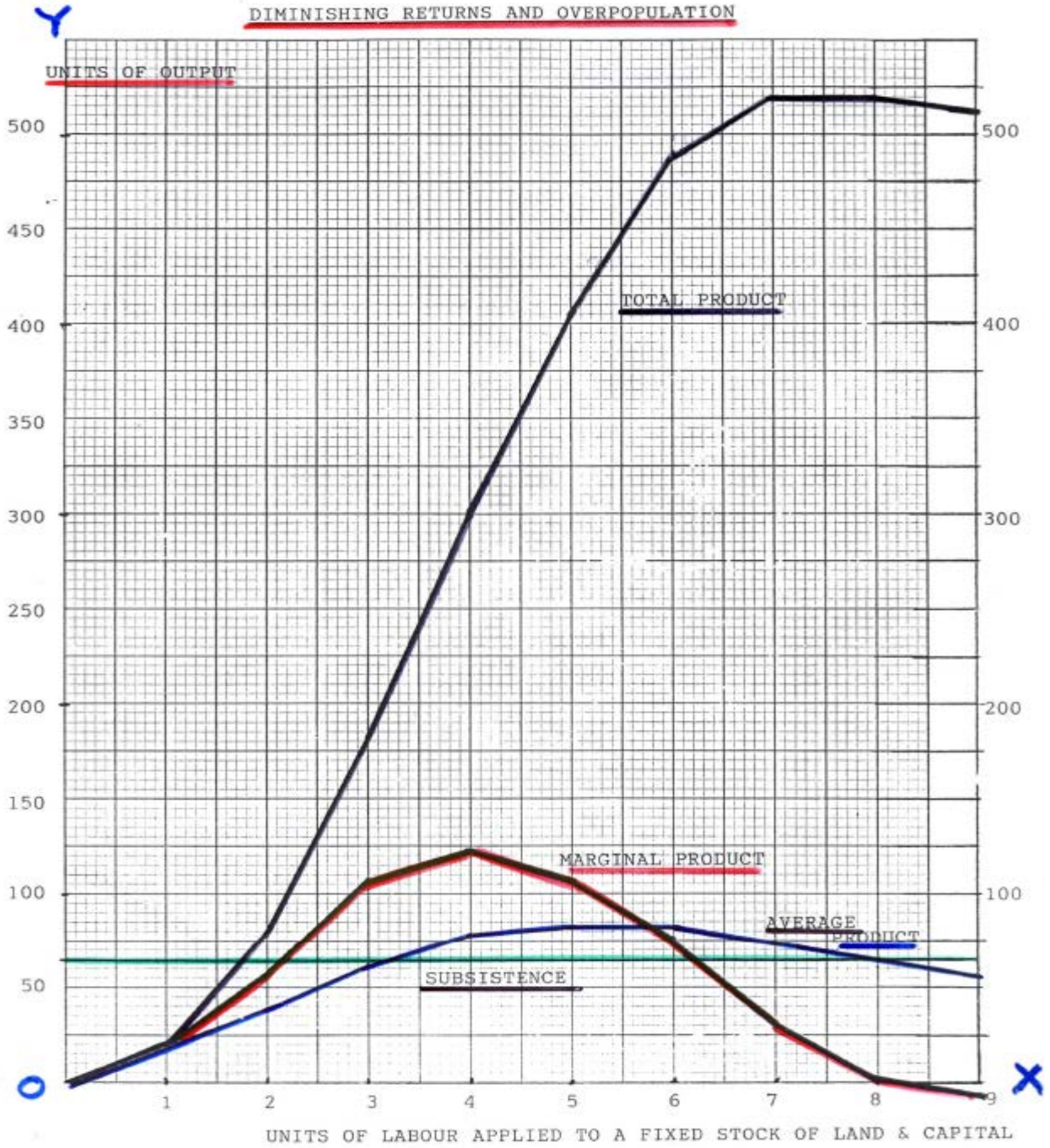
changes in agricultural productivity with population growth

The Fixed Factor(s):	a fixed stock of land (10 hectares) and a fixed stock of capital (**K**).
The Variable Factor:	units of labour (**L**) added per year to the fixed stock of land and capital
K/L	the ratio of land + capital (**K**) to labour (**L**)
Total Product	Total output produced by the variable units of labour working this land in the course of a year (bushels of wheat, or eggs, or apples, etc.)
Average Product	Total output divided by the total quantity of labour working the land that year
Marginal Product	The extra (marginal) output produced by adding one *extra* unit of labour per year: the extra contribution to output provided by an additional unit of labour per year

Note that the Marginal Product curve, while descending, intersects the Average Product curve at the latter's peak. The Marginal Product curve determines the slope of the Total Product curve; and when Marginal Product becomes negative, Total Product begins to decline.

Law of Diminishing Returns: with population growth



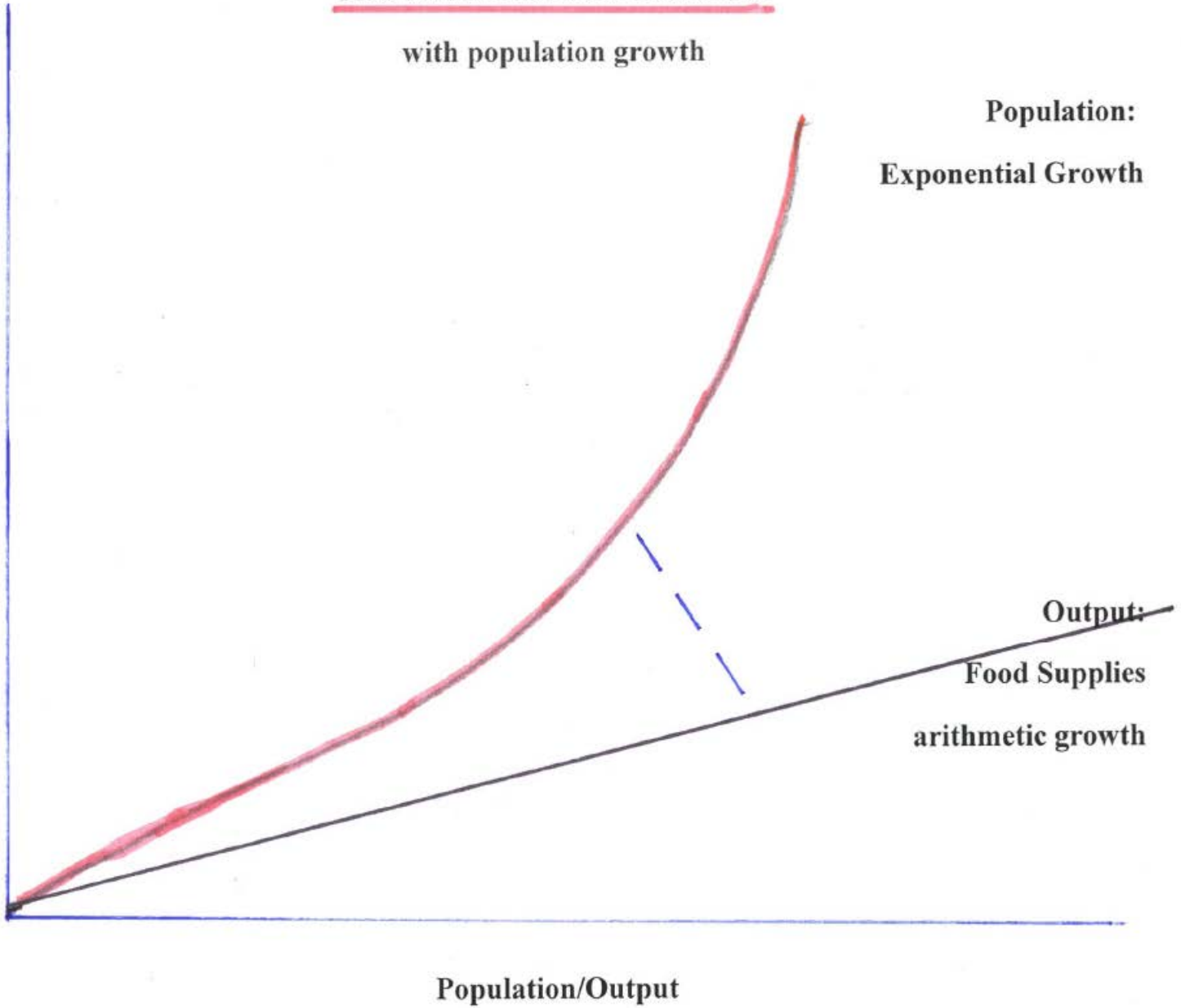

DIMINISHING RETURNS AND OVERPOPULATION
Y
UNITS OF OUTPUT
500
450
400
350
300
250
200
150
100
50
O
TOTAL PRODUCT
MARGINAL PRODUCT
AVERAGE PRODUCT
SUBSISTENCE
1
2
3
4
5
6
7
8
9
X
UNITS OF LABOUR APPLIED TO A FIXED STOCK OF LAND & CAPITAL

Classical Economists on Population Growth

- (1) **Robert Thomas Malthus** (1766-1834): *Essay on the Principle of Population* (1798)
- a) **that population tends to grow exponentially (geometrically)** – If left unchecked
- b) **but output – food supply – grows,** at best, **only arithmetically**
- (2) **David Ricardo** (1772 – 1823)
- - **Theory of ECONOMIC RENT**: role of population growth in determining grains prices ➔ determining land rents and real incomes

THE MALTHUSIAN PROBLEM

with population growth



Malthus & Malthusians

- (1) **Malthus did not believe** that population would continue to grow unchecked: because of
- - **Providential or Positive Checks:** war, famine, disease, etc. (Four Horsemen of Apocalypse)
- - **Prudential or Preventive Checks**: the European Marriage Pattern in controlling fertility (next day)
- (2) **But most economic historians have adopted a pessimistic Malthusian view**: that population growth ultimately halted economic growth
- – **until the Industrial Revolution** broke that barrier (from about the 1820s – not before)

Causes of Demographic Changes

- (1) **Endogenous Factors**: working within the economy as a whole
- - **thus the Malthusian model**: population growth → falling real wages & real incomes
- - **subsistence crises →** demographic crises (as in the Lindert graph)
- (2) **Exogenous Factors**: from the outside: Providential checks of war, famine, disease

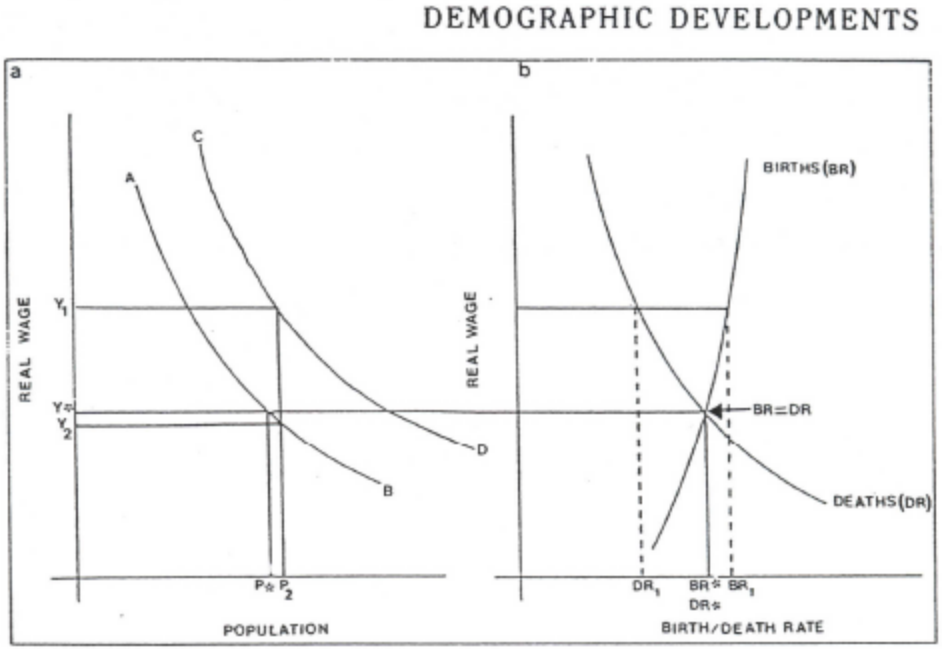


Figure 2.1: Malthusian dynamic equilibrium

BR = crude Birth Rate
DR = crude Death Rate
Y = real wage
P = Population

BR* = equilibrium birth rate
DR* = equilibrium death rate
Y* = equilibrium real wage
P* = equilibrium population

AB = aggregate production function at T_o
CD = aggregate production function at T_1

Equilibrium: when BR = DR

Diminishing Returns and the Malthusian Problem: I

- 1) **The Law of Eventually Diminishing Returns** is the proper, correct way of viewing this economic axiom
- 2) **Consequences of population growth**: depend on whether the economy, at the outset of the case study:
- - is underpopulated or overpopulated
- - in terms of available, land, capital, technology,
- 3) **When underpopulated, additions of labour** to fixed stocks of K (land and capital) led to **increasing** marginal productivity -
- - because labour can be used more efficiently
- - through specialization of labour tasks

Diminishing Returns and the Malthusian Problem: II

- 4) **Diminishing returns** set in ONLY AFTER population growth has reached its economically feasible maximum
- - even so, note that the marginal product curve descends **before** the average product curve reaches it maximum output
- 5) **Subsistence crises will occur** only after the average product curve descends further – and crosses the subsistence level (however defined)
- 6) **Technological changes + additions** of new land and capital will check, postpone any such crises

Population growth and the agrarian economy

- **Suppositions: in following model**
- 1) **Agricultural economy is one of Mixed Husbandry** using **both PASTURE** for livestock and **ARABLE** for grain & other crops
- 2) **More calories per acre** - produced from crops (arable) than from livestock (pasture): about 4:1
- 3) **Livestock required for** food, manure (fertilizer), and power (pulling ploughs and carts)
- 4) **Population Growth**: Arable expands at the expense of pasture lands

The Effects of Changing Relative Areas of Grasslands (livestock-pasture) and Arable (grain crops) on the Output of a 100-acre Farm:

in bushels per acre (with livestock output equivalents)

Model: Farm Operating on a Three-Field System with 2/3 in Crops and 1/3 Fallow (Uncultivated, Land at Rest) each Year

Grass Area in Acres	Grain Area in Acres	Fallow Area (at Rest): Acres	Manure Tons per Acre Arable	Grain Yield: Bu. per Acre	Total Grain Output Bu.	Stock Output in Equiv Bu.*	TOTAL OUT-PUT IN BU.
100	0.0	0.0				1,000	1,000
80	13.3	6.7	>10.0	27.5	366	800	1,166
77	**15.3**	**7.7**	**10.0**	**27.5**	**421**	**770**	**1,191**
60	26.7	13.3	4.5	16.5	441	600	1,041
40	40.0	20.0	2.0	11.5	460	400	860
20	53.3	26.7	0.7	8.9	474	200	674
0	66.7	33.3	0.0	7.5	500	0	500

* **Assumption:** That the output of livestock products is equivalent to 10 bushels of grain per acre.