

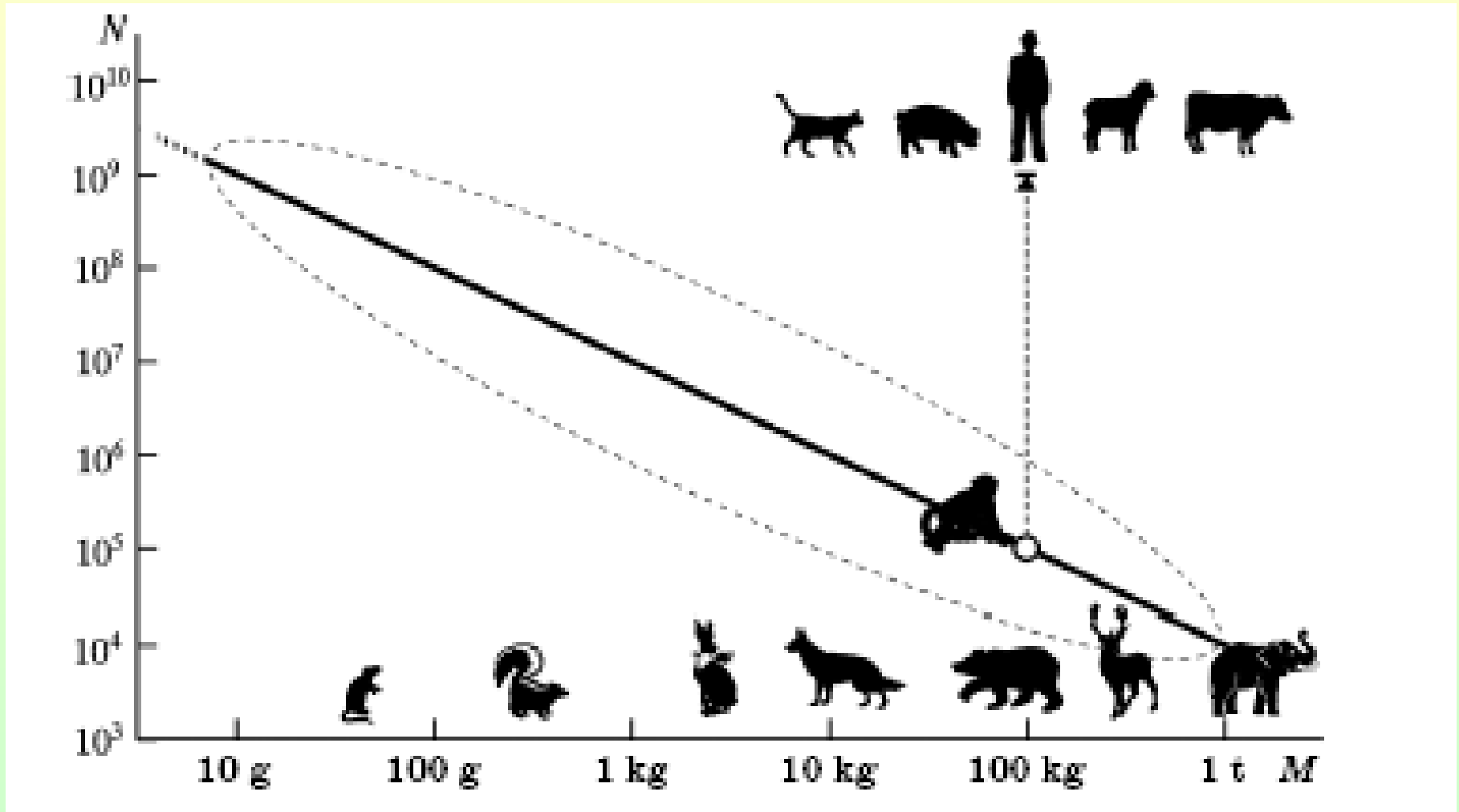
# **GLOBAL POPULATION BLOW-UP AND AFTER**

**The Demographic Revolution  
and  
The origin and meaning of the crisis**

**Sergey P. Kapitza**

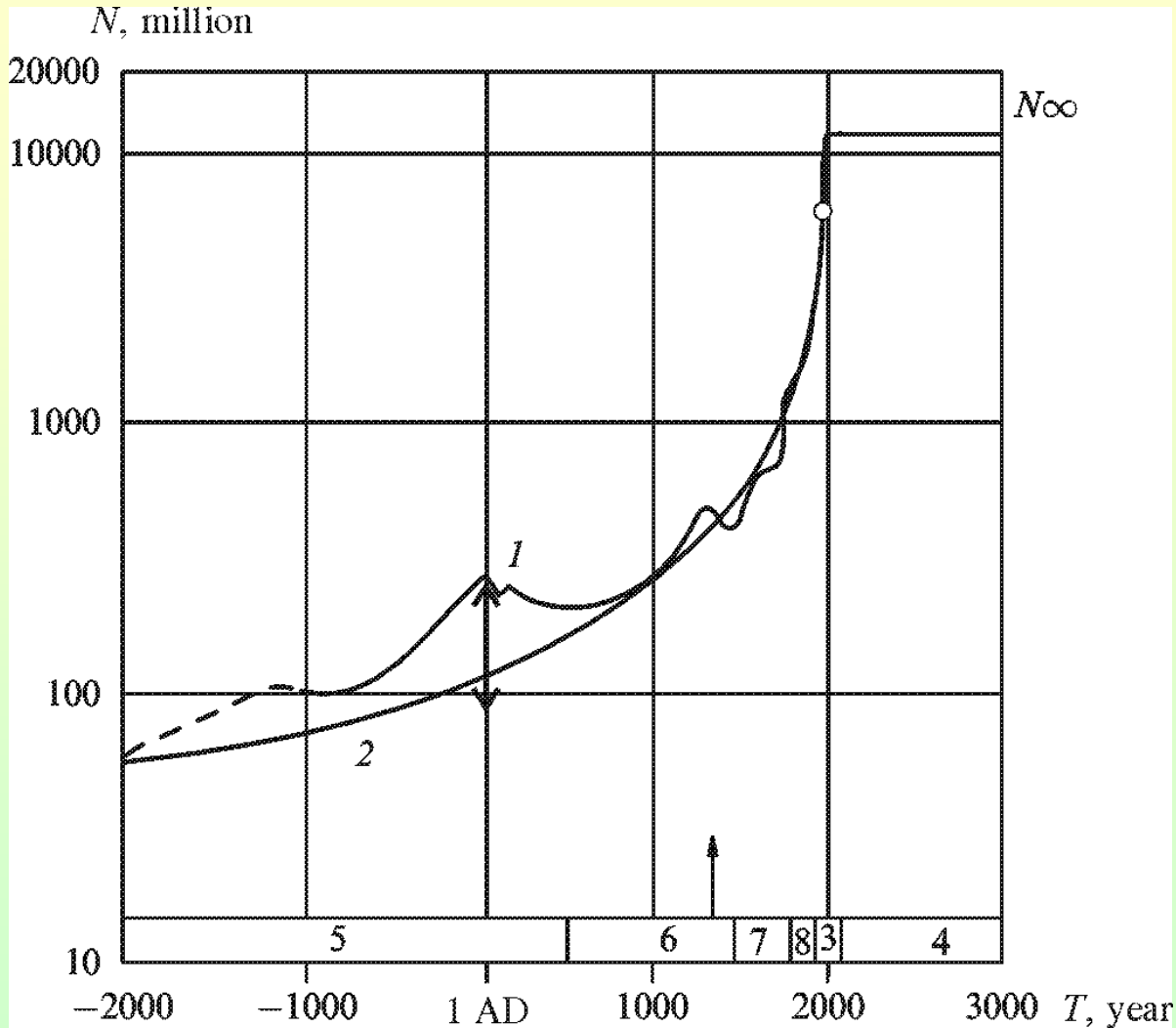
Institute for Physical Problems  
Russian Academy of Sciences, Moscow

# HOW MANY PEOPLE ARE THERE ON EARTH?



NUMBERS OF A GENERA DEPENDING ON BODY WEIGHT

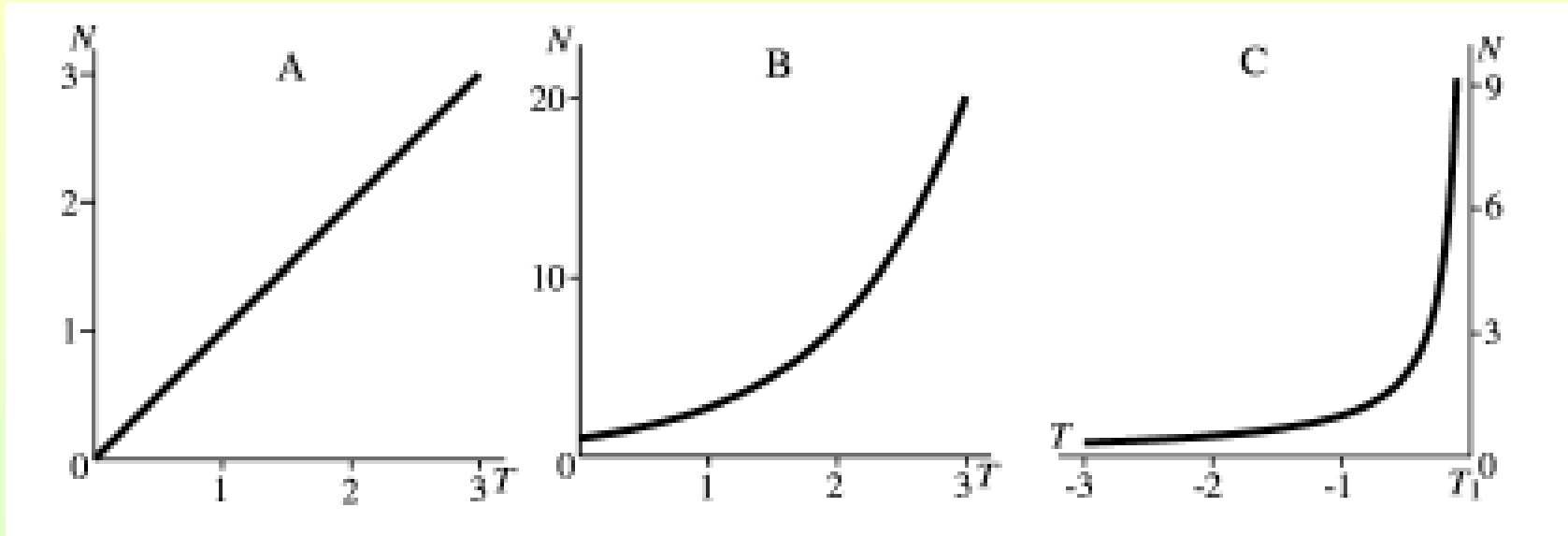
# WORLD POPULATION FROM 2000 BC TO 3000 AD



1 – DATA OF BIRABEN, 2 – BLOW-UP, 3 – DEMOGRAPHIC TRANSITION, 4 – STABILIZED POPULATION  
 5 – ANCIENT WORLD, 6 – MIDDLE AGES, 7 – MODERNITY, 8 – RECENT HISTORY,  $\uparrow$  – THE PLAGUE 1348



# LINEAR, EXPONENTIAL AND HYPERBOLIC GROWTH



$$\frac{dN}{dT} = A \quad N = AT \quad \frac{dN}{dT} = \frac{N}{\tau} \quad N = N_0 \exp T/\tau \quad \frac{dN}{dT} = \frac{N^2}{C} \quad N = \frac{C}{T_1 - T}$$

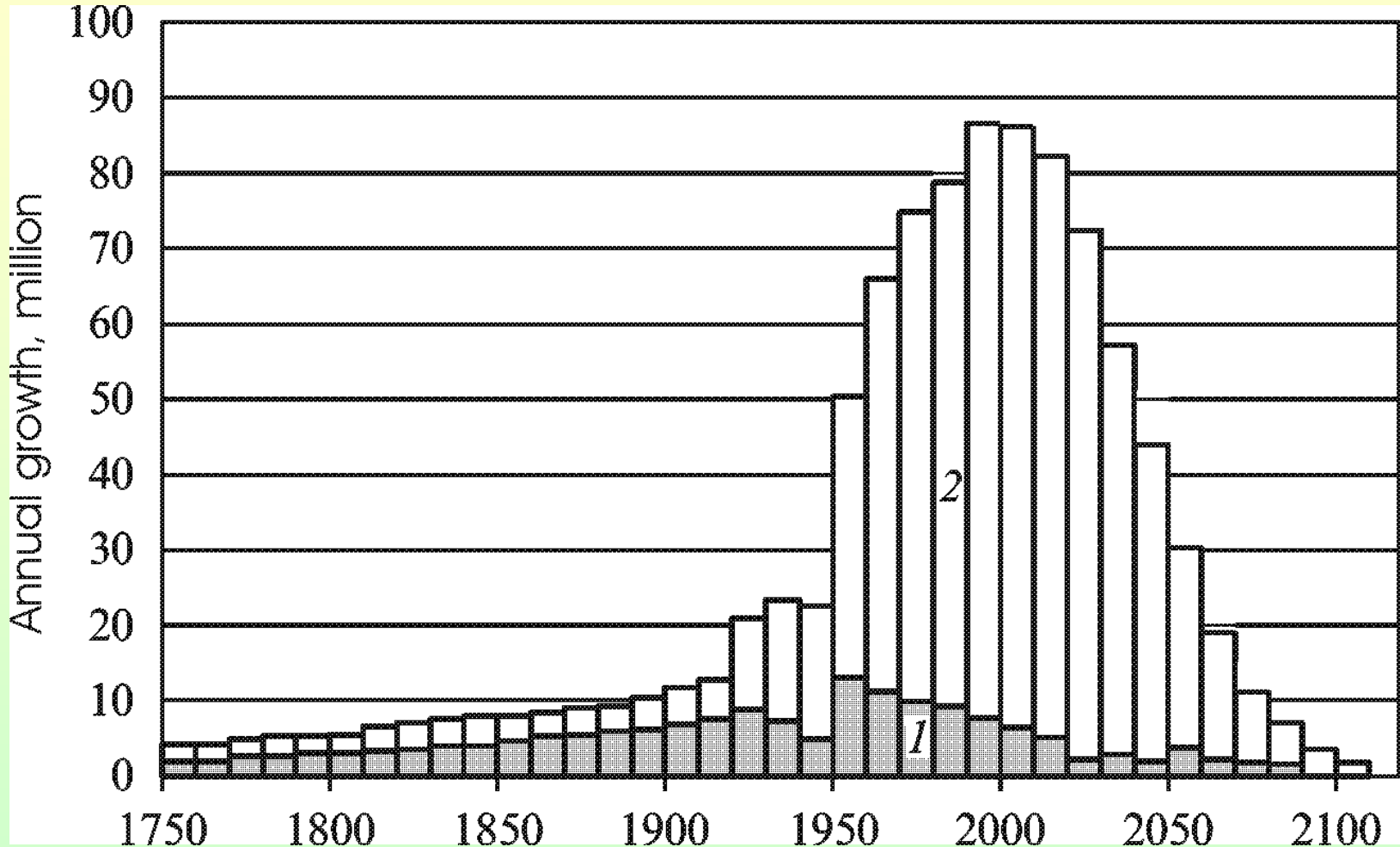
REGULARIZING GROWTH AT THE SINGULARITY AT  $T_1$   
ESTABLISHES  $N$  AS THE PARAMETER OF ORDER.

$$\frac{dN}{dT} = \frac{C}{(T_1 - T)^2} \quad \frac{dN}{dT} = \frac{C}{(T_1 - T)^2 + \tau^2}$$

INSTANTANEOUS EXPONENT IS THE AGE OF THE EPOCH:  
LINEAR AND HYPERBOLIC GROWTH ARE SELF-SIMILAR.

$$T_E = T_1 - T$$

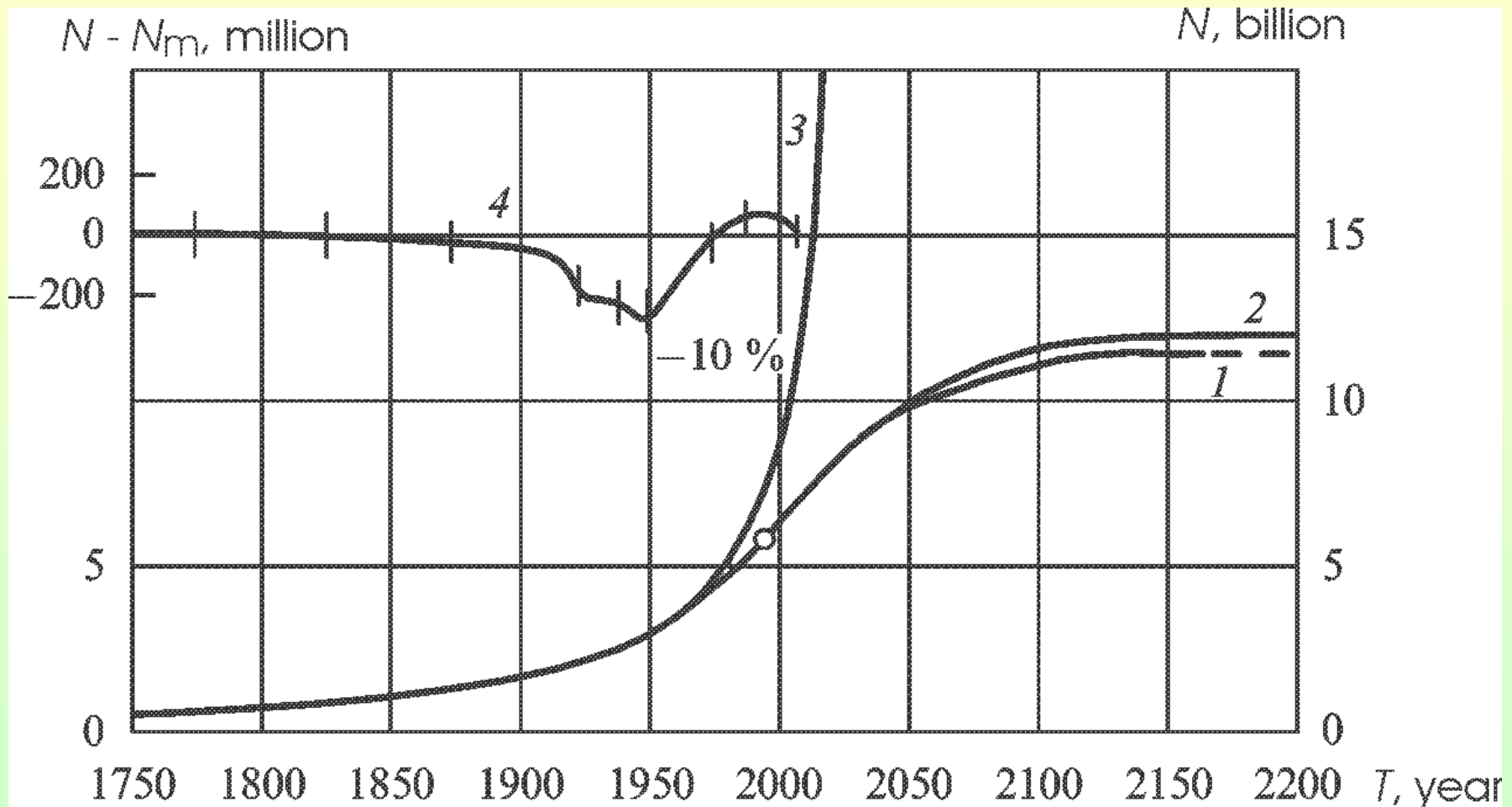
# GLOBAL DEMOGRAPHIC TRANSITION



ANNUAL GROWTH AVERAGED OVER A DECADE

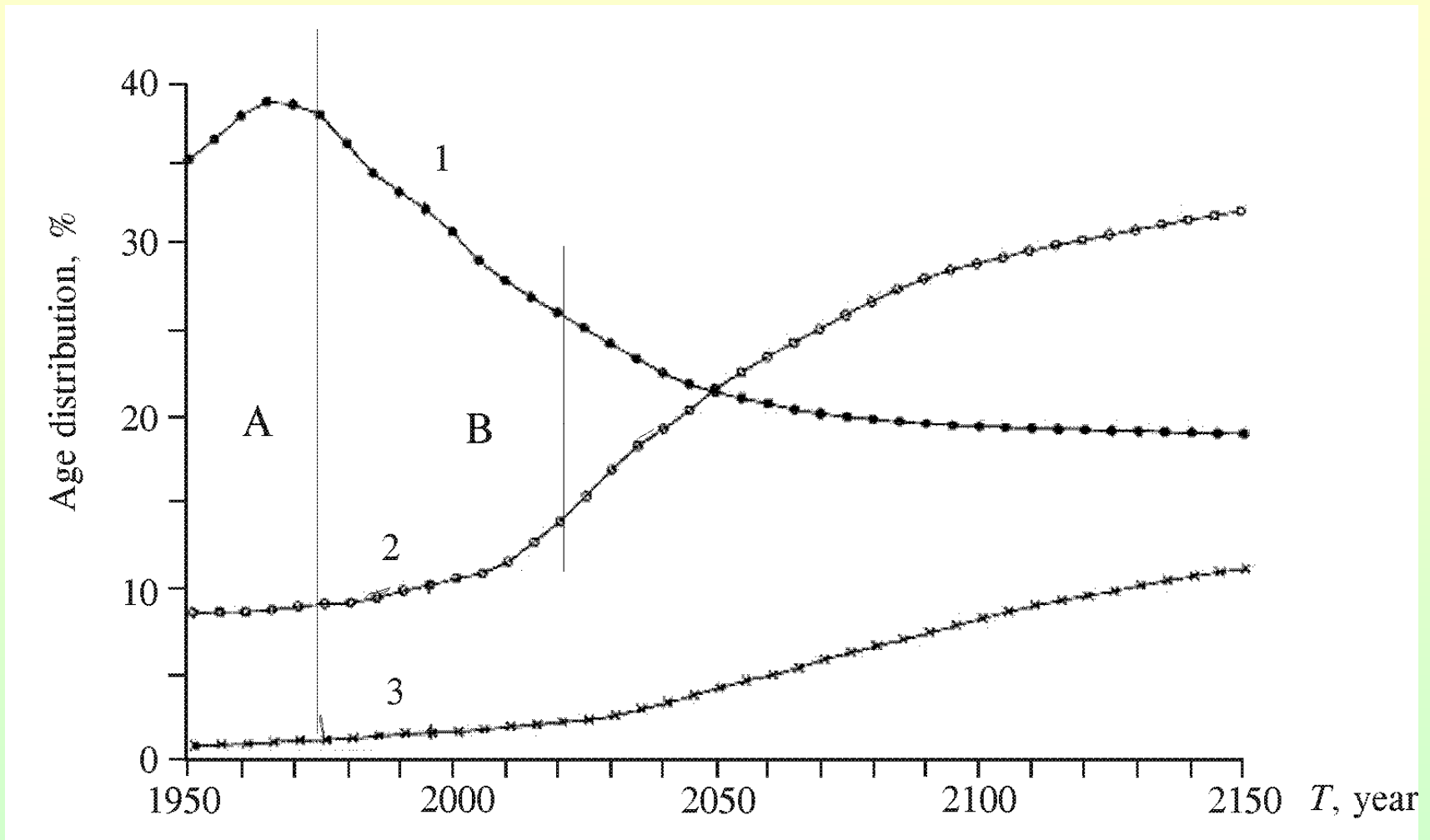
1 – DEVELOPED AND 2 – DEVELOPING COUNTRIES

# POPULATION OF THE WORLD 1750–2200



- 1 – PROJECTIONS BY IIASA AND UN, 2 – MODEL, o – 1995  
 3 – BLOW-UP, 4 – DIFFERENCE OF MODEL AND PROJECTIONS x 5 times

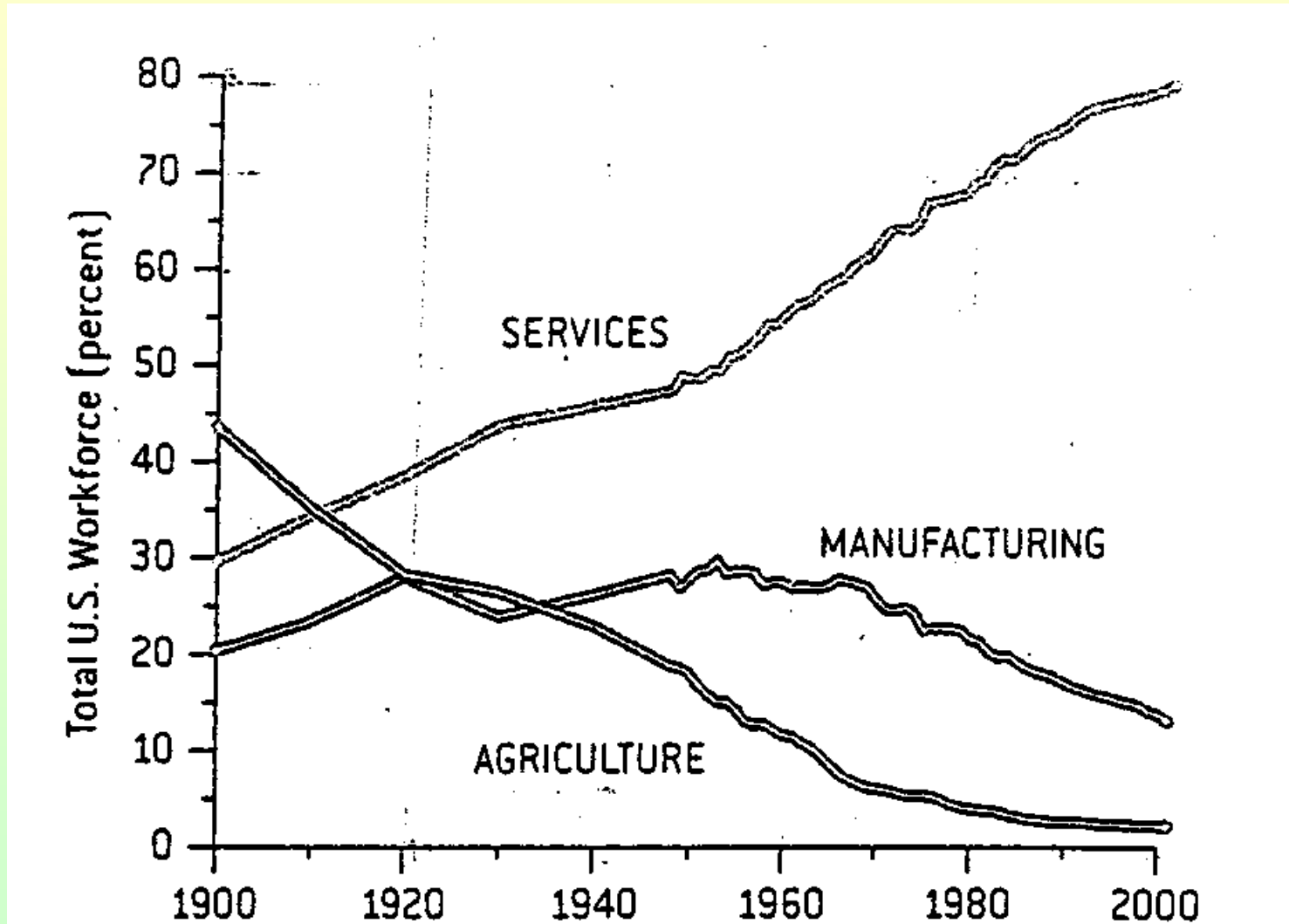
# AGEING OF THE GLOBAL POPULATION



1 – AGE GROUP YOUNGER THAN 14 YEARS, 2 – OLDER THAN 65 YEARS,  
3 – OLDER THAN 80, A – DEVELOPING, B – DEVELOPED COUNTRIES



# DEINDUSTRIALIZATION



DISTRIBUTION OF U.S. WORK FORCE IN 20-th CENTURY

# PRINCIPLES OF META-ECONOMICS

- RIGHT FROM THE BEGINNING, GROWTH OF MANKIND WAS DETERMINED BY GENERALIZED INFORMATIONAL FACTORS THAT MODERATED SOCIAL EVOLUTION AND DEVELOPMENT
- GLOBAL SYSTEM IS FAR FROM EQUILIBRIUM, HENCE GROWTH OF INEQUITIES
- THE GLOBAL DEMOGRAPHIC TRANSITION TO A STABILIZED POPULATION IS DETERMINED BY THE LIMITS OF THE INFORMATION SOCIETY
- THE FUTURE WILL BE DETERMINED BY THE «SOFTWARE» — CULTURE OF AN INFORMATION DOMINATED WORLD, RATHER THAN THE «HARDWARE» OF INDUSTRY, AS IN THE PAST

# The physics of global demography

- Information and nature of the global interaction
- The demographic revolution as a phase transition
- The theory of growth is nonlinear, non local, and growth is irreversible
- Principle of the demographic imperative and independence of growth on resources
- The stability of growth and instability of history
- The demographic revolution as the greatest change in the human story
- Problems in the physics of growth of humanity:
- Nature of time in history: Time-2 is the log of Time of physics. Cosmology and growth of humankind