Centrally Planned Economies: Industrial Organisation and Structural Inefficiencies

- **Planning theory and planning practice**
  - ***Setting the production quotas***
  - ***Rationing the supply of resources***
  - ***Planning procedure, material balances***
  - ***Why central planning creates disproportion***
- **Concentration and specialization of enterprises**
- **Material inputs and inventories**
- **Capital productivity**
  - low capacity utilization rate
  - slow retirement of fixed capital stock
  - long construction periods
- **Static efficiency**
- **Technical progress**

Planning theory

The simplified basic equation of the input-output model describes the distribution of output of each particular product:

$$x_i = \sum_{j=1}^{n} a_{ij} x_j + y_i + E_i - I_i + s_i ,$$

where x_i, y_i, E_i, I_i, s_i - volumes of production, final consumption, export, import and change in stocks of i-product respectively,

while a_{ij} - input-output coefficients, i.e. inputs of i-product per unit of j-product output.

The utility function is:

$$F = ay_1 + by_2 + \ldots + wy_n \Rightarrow max,$$

where a, b, ... w - parameters, fixing the structure of final consumption.

Planning practice: material balances

- **Principle #1: Production quotas ("plan of product nomenclature")**
  - **Gosplan provided plans for 2,000 product groups**
  - **Gossnab divided them into 15,000 positions**
  - **Ministries divided them into 50,000 positions**
  - **Finally, each product position was sub-divided into into 10-15 specific products at a stage of linking suppliers and users**
  - **So about 0.5-0.75 million items were planned, whereas 25 million items of goods were produced**
- **Principle # 2: Centralized allocation of resources**
  - **Materials and equipment supply plan for every enterprise**
  - **Enterprises obtain from higher authorities a supply plan with precise assignment of producers and volume of deliveries**

Limitations of central planning

- **All direct and indirect resource inputs must be calculated**
- **In practice, it is impossible to gather all the necessary information:**
    - To many products
    - Costs of information gathering
    - Unobservable variables, e.g. technological coefficients for new products and technologies, parameters of demand function
- **Central planning creates disproportions**
  - No physical capacity to draw up an optimal plan
  - For than reason, mistakes are inevitable
  - Corrections of the plan were a universal practice
  - The majority of goods was either in short supply or in surplus

Fulfillment of Plans

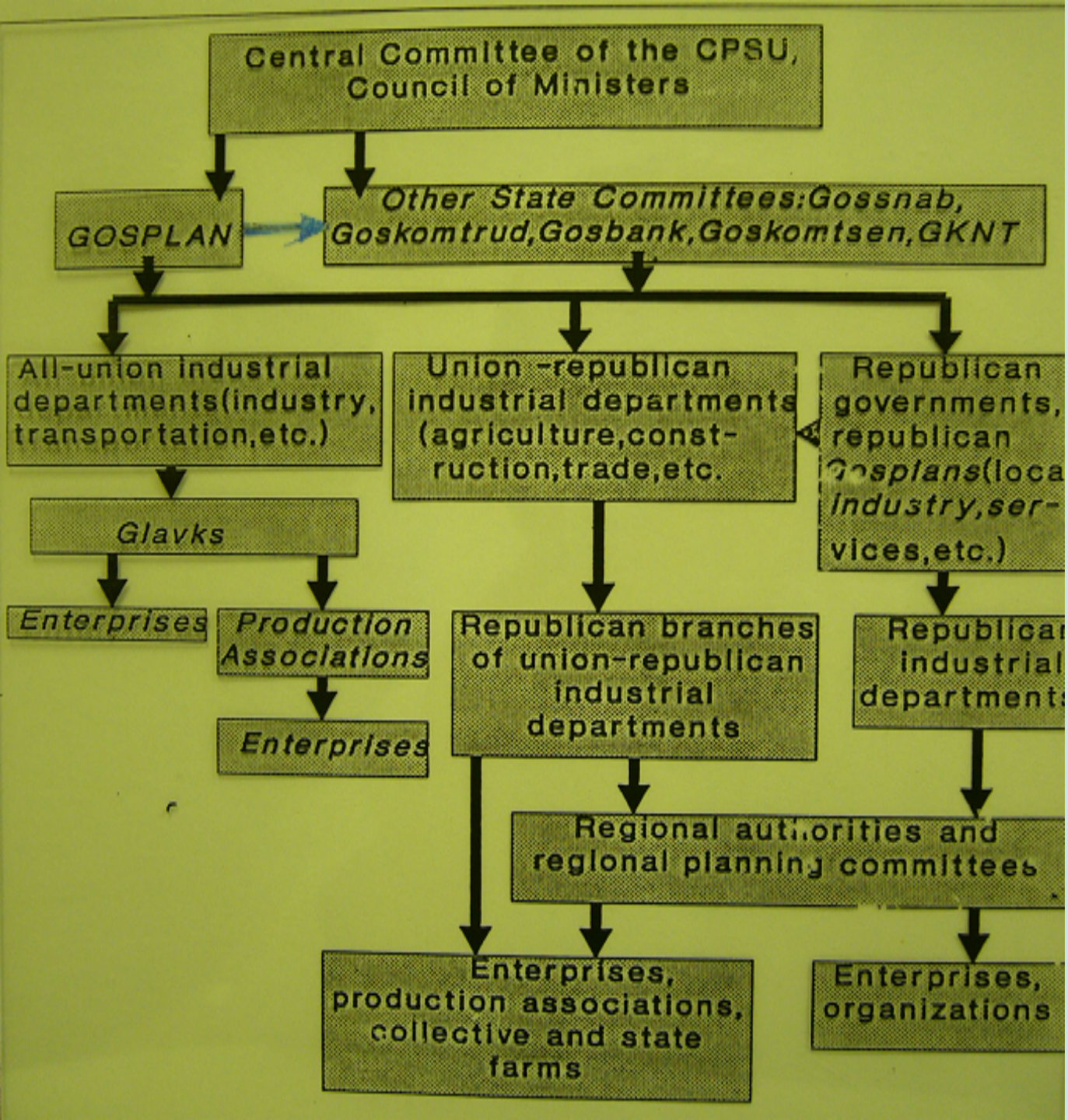
- Production plans were not fulfilled, since enterprises were not provided with resources - shortages and overproduction was a rule rather than the exception
- Actual production growth rates for individual enterprises had nothing in common with plan targets
- Simple extrapolation of the trend of the five years are better predictors of actual output than planned guidelines
- Plans were constantly corrected
- “Bargains” between Gosplan, branch-industry ministries, and enterprises over exactly what can be produced
- Iteration process - multi-phased negotiations

Structural Inefficiencies: Industrial Organization

- Concentration, horizontal and vertical integration, diversification
- Specialization: How and why the planners overburdened the enterprises with non-profile activities
- Specialization: How and why enterprises and ministries tended to be self-sufficient
    - *Enterprises*
    - *Ministries*
    - *Co-ordination between ministries*

Planning and Management Organization

- Management organized by industrial sectors and territories
- By territory: Some businesses under authority of the Union Republics and local administrative bodies (agriculture, services, light industry)
- By sector: About thirty all-union ministries responsible for manufacturing and mining; *Glavki* (main directorates) within ministries responsible for sub-industries (four-digit level) - heavy industry, transportation, communications, finance
- Drawbacks of this structure of management:
    - Weak inter-sectoral or inter-regional cooperation
    - Attempts to reform the structure of management: late 1950s (sovnarkhozy), 1970s (science-production associations), 1980s (RAPO - regional agro-industrial associations)



Management hierarchy of the Soviet economy

Share of all-union and republican enterprises in total industrial output and capital stock, 1989

Republics	Enterprises subordinated to all-union ministries		Enterprises subordinated to union-republican and republican ministries	
	Share in		Share in	
	Output,%	Capital stock,%	Output,%	Capital stock,%
USSR	61.4	81.1	38.6	18.9
RSFSR (Russia)	69.0	86.8	31.0	13.2
Ukraune	58.0	72.8	42.0	27.2
Byelorussia	53.5	74.4	46.5	25.6
Lithuania	39.2	66.1	60.8	33.9
Latvia	38.7	62.2	61.3	37.8
Estonia	28.5	59.0	71.5	41.0
Moldova	28.4	48.2	71.6	51.8
Armenia	50.8	71.9	49.2	28.1
Georgia	31.4	65.9	68.6	34.1
Azerbaidjan	46.7	81.4	53.3	18.6
Kazakhstan	49.5	67.0	50.5	33.0
Uzbekistan	34.8	66.1	65.2	33.9
Turkmenistan	37.0	83.0	63.0	17.0
Kirghizia	33.0	69.0	67.0	31.0
Tadjikistan	28.9	72.4	71.1	27.6

Source: *Narodnoye Khozyaistvo SSSR v 1989 godu* (National Economy of the USSR in 1989). Moscow, 1990, p. 331.

Indicator	Absolute value	% of total
Total number, million - individual plots - collective orchards and vegetables gardens	30 18.5	Nearly 100% of families living in rural areas and some families living in urban areas 17% of families living in urbar areas
Agricultural land area, million hectares - individual plots - collective orchards and vegetable gardens	4.5 1.3	0.8 0.2
Sowed land, million hectares	2.8	1.2
Fixed production agricultural capital stock, billion rubles (excluding cattle)	6.2	2.0
Cattle overhead, million heads - cattle - pigs - sheep and goats	 24.2 15.2 36.3	 20 19.0 25
Meat production, million tons	5.1	25.4
Milk production, million tons	29.4	27
Egg production, billion pieces	22.4	26
Wool production, million tons	0.13	28
Potatoes	42.5	59
Vegetables, million tons	8.5	30
Fruits and berries, million tons	5.6	58
Total agricultural production, billion rubles	57.3	25
Agricultural production for sale		10
Labor productivity, collective and state farms=100%, estimate		40%
Capital productivity, collective and state farms		over 17 times
Land productivity, collective and state farms		over 30 times

Agricultural production in individual land plots, 1989-90

Source: *Narodnoye Khozyaistvo SSSR* (National Economy of the USSR) for various years; *Ekonomika i Zhiz'n*, 1991, N6;

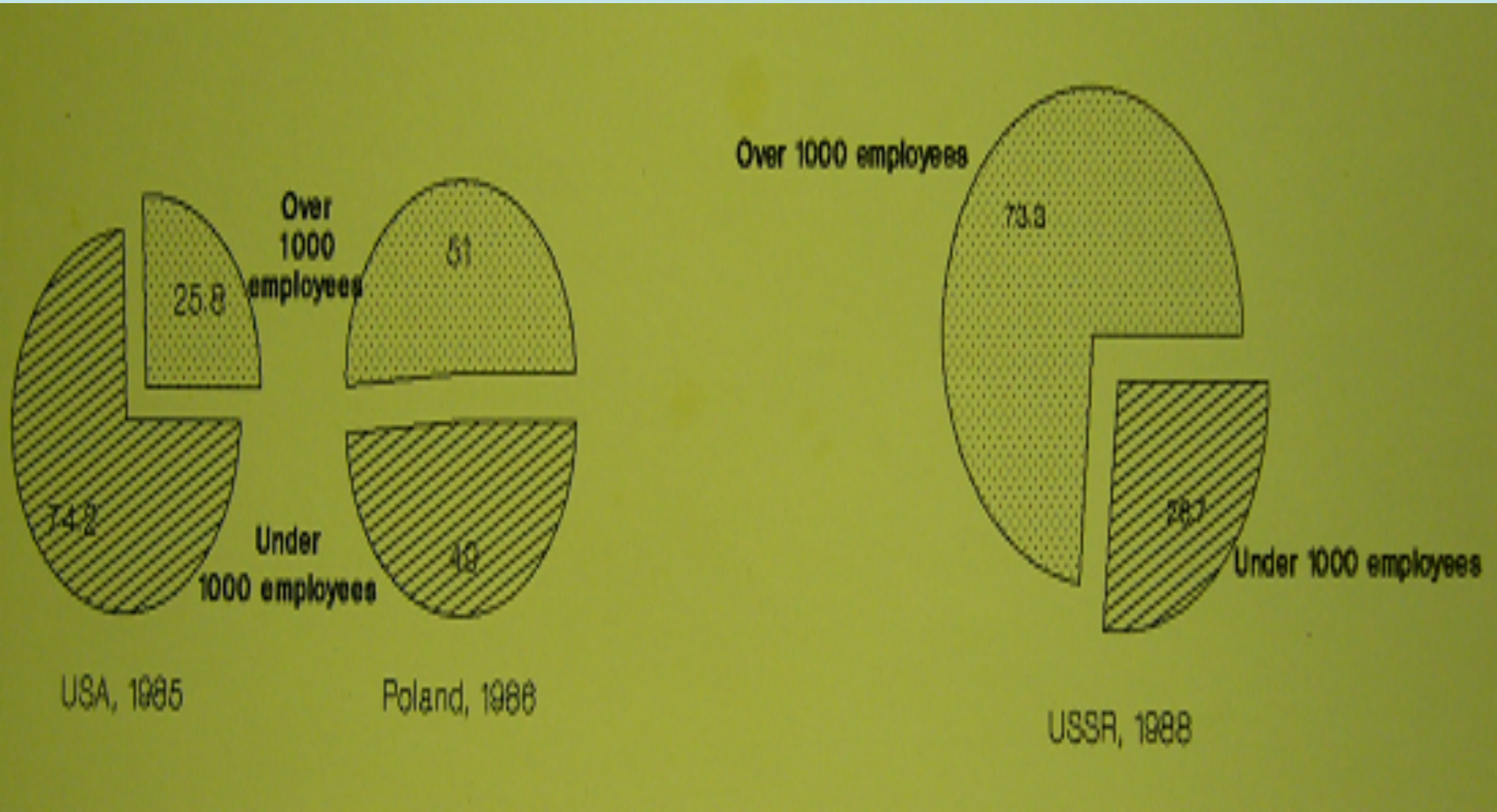
1990, N21, 22.

Concentration

- In 1986, there were about 514,000 business entities in the country:
  - 46,000 industrial enterprises
  - 50,000 collective and state farms
  - 32,000 construction associations
- Soviet enterprises were the largest in the world
  - Average industrial enterprise had about 1,000 workers
  - Average collective or state farm had 500 workers

Share of enterprises with over 1000 employees in total industrial output

(Izvestiya – Financial Times, April 1992)



Concentration in the industrial sector of the USSR and some OECD countries, late 1980s

Enterprises with number of employees:	Share of enterprises of indicated size in total number of enterprises with over 10 employees	
	USSR	Six OECD countries[a]
10-100	2.2	35.0
101-500	15.3	33.0
501-1000	12.5	13.0
Over 1000	70.0	19.0
Average number of employees	834	86

[a] Austria, Belgium, France, Italy, Japan, Sweden.

Source: *Business in the USSR*, January 1991 (N1), p. 65.

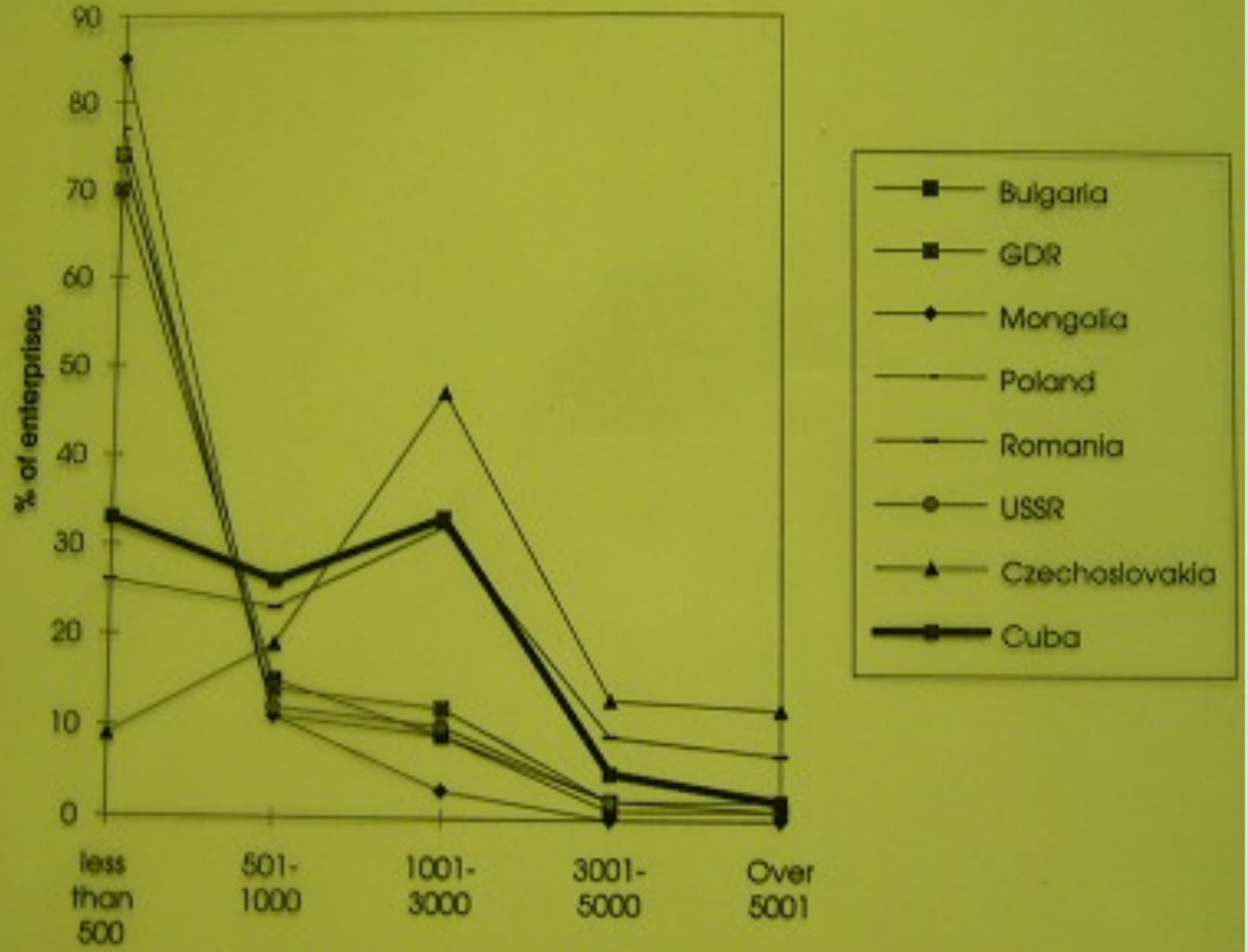
Average size of enterprises in selected industries, EC and the USSR, 1987

Industry	Number of employees per enterprise		Ratio, USSR/EC[a]
	EC	USSR	
Iron and steel	517	3833	7.4
Non-ferrous metals	160	2699	16.9
Machine-building and metal working	196	2699	13.8
-Electrotechnical industry	299	1645	5.5
-Non-electrical machine-building	102	1468	14.4
-Motor vechicles	705	4828	6.8
Chemicals	221	1871	8.5
Construction materials	126	437	3.5
Light industry	102	650	6.4
Agricultural processing	183	289	1.6
TOTAL	163	846	5.2

[a] West Germany, Denmark, France, Italy, Netherlands, United Kingdom.

Source: *Stabilization, Liberalization and Devolution: Assessment of the Economic Situation and the Reform Process in the Soviet Union*. Commission of the European Communities, December, 1990, p. 36.

Fig. Distribution of industrial enterprises by size of , % of total



Concentration

- Primarily horizontal integration of production in USSR - activities of enterprises concentrated primarily in one field (due to industry-branch principle of management)
- One and only one ministry was responsible for the output of each major type of product
    - Without the formal permission of the Ministry of Auto industry, it was forbidden to produce car trailers
- Soviet enterprises were large, but only horizontally integrated. No vertically integrated enterprises and diversified enterprises, like IBM or General Motors

Concentration in agriculture

- Number of farms
  - In 1929: about 20 millions at the start of collectivization
  - In 1940: 237,000 collective farms, 4,000 state farms, less than 1 million individual peasant farms
  - In 1950: 130,000 collective and state farms
  - In 1960: about 50,000 collective and state farms, individual farms disappeared (poorest collective farms were transformed into state farms later on)
  - In 1989: 28,000 collective farms, 23,000 state farms
- Average collective or state farm in 1980s:
  - 500 employees
  - 20,000 hectares of land; 10,000 hectares of agricultural land
  - Extremely large size, too big to be efficient

Specialization: enterprises were forced by the planners to produce goods and services that had nothing to do with their mainstream production. Why? To overcome shortages that inevitably resulted from central planning

- **Examples:**
  - **Periodic campaigns to develop auxiliary agricultural operations to contribute to "the fulfillment of food program"**
  - **More than 20,000 auxiliary agricultural units attached to factories, construction sites and even military units**
  - **One quarter to one third of all enterprises had agricultural units**
  - **Targets for consumer goods production for all enterprises, including defense**
  - **Obligatory participation in seasonal agricultural works**
    - assistance to farms during sowing and harvesting campaigns
  - **Obligatory participation in road construction**
    - Every enterprise in the region was required to provide trucks, tractors, excavators, etc. (with drivers) for six working days a year for the construction of local roads
  - **Hectare-based principle of planning**
- **For the planners such a "universal campaign method" was the only possible way to overcome shortages, even though at a cost of efficiency**

Auxiliary agricultural units of non-agricultural enterprises, 1988

Indicator	Absolute volume	Share of total,%
Number of auxiliary units, thousands	22.2	-
Agricultural land, million hectares	7.7	1.3
Arable land, million hectares	2.1	0.9
Cattle population, million heads	1.1	0.9
Pig population, million heads	2.8	3.6
Meat production, million tons	0.4	2.0
Milk production, million tons	0.8	0.7
Potatoes production, million tons	0.4	0.6

Source: *Narodnoye Khozyaistvo SSSR v 1989 godu* (National Economy of the USSR in 1989). Moscow, 1990.

Specialization: “Do it yourself”

- Directors of enterprises strived to have everything at hand not depend on suppliers
- It was easier to produce needed nuts and bolts than to arrange the supply process
- So whole constellation of repair, instrument, construction, and packing and other auxiliary shops and subdivisions surrounded the basic production facility
- The production costs at such subdivisions were 2-3 times higher than at specialized enterprises
    - In the mainstream production labor productivity was 75% of the level in Western countries
    - In the industry overall - 60% of the level in Western countries
- Many companies carried out their own construction (12% of all construction works)
- More workers (8 million) repaired equipment than produced it
- Cost of servicing equipment and repair was 8-10 times higher than initial costs of the machines

Self-sufficiency at the industry-branch (ministry) level

- Requesting something from the other ministry was troublesome and there was no guarantee that the promises would be honored
- Ministries tended not to procure goods from “outsiders”, even if they were conveniently located, but preferred to get supplies from their own plants (subordinated to the same ministry)
- This caused irrational cargo shipping
- Many ministries had their transportation units, recreation facilities, forest territories (to procure lumber and timber)

Specialization: Costs of departmental barriers

- Greatest problems with interaction of enterprises emerged at the borders of sectors or regions
  - Scientific and technical progress, introduction of new equipment and technology suffered the most (most innovations are of inter-industry type)
  - Inventions demanding interdepartmental coordination were introduced very slow
  - This is why USSR lagged behind in the production of computers, biotechnology, composite materials
  - Successful examples of technical progress include nuclear energy and missiles production (partly due to military priorities, partly - to timely establishment of new management bodies - Ministry of general machine building and Ministry of average (medium) machine building
- Lack of small-scale specialized factories
  - Ministries were accountable only first and foremost for the key products
  - Major shortages of products of secondary importance (“trifles”, *melochevka*)

Major structural inefficiencies in Soviet economy resulting from its industrial organization

- **Consciously and unconsciously the planners tried to have large enterprises (to reduce the number of planned targets)**
- **Large enterprises were not bad, but there was a lack of vertically integrated and diversified enterprises**
- **No small specialized enterprises**

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- **The planners overburdened the enterprises with a whole range of activities unrelated to their mainstream production**
    - Not being able to elaborate the appropriate production ties between specialized enterprises, the planners often launched campaigns urging every enterprise to contribute to the production of the particular items - if everyone will produce a little bit, the shortage may disappear
- **To protect themselves from regular disruptions of deliveries of supplies enterprises, ministries and regional authorities strived for self-sufficiency and autarchy,**
    - via creation of numerous small and inefficient repair, construction, mechanical, instrumental, transportation and other auxiliary units - not efficient, but badly needed to overcome interruptions of supplies

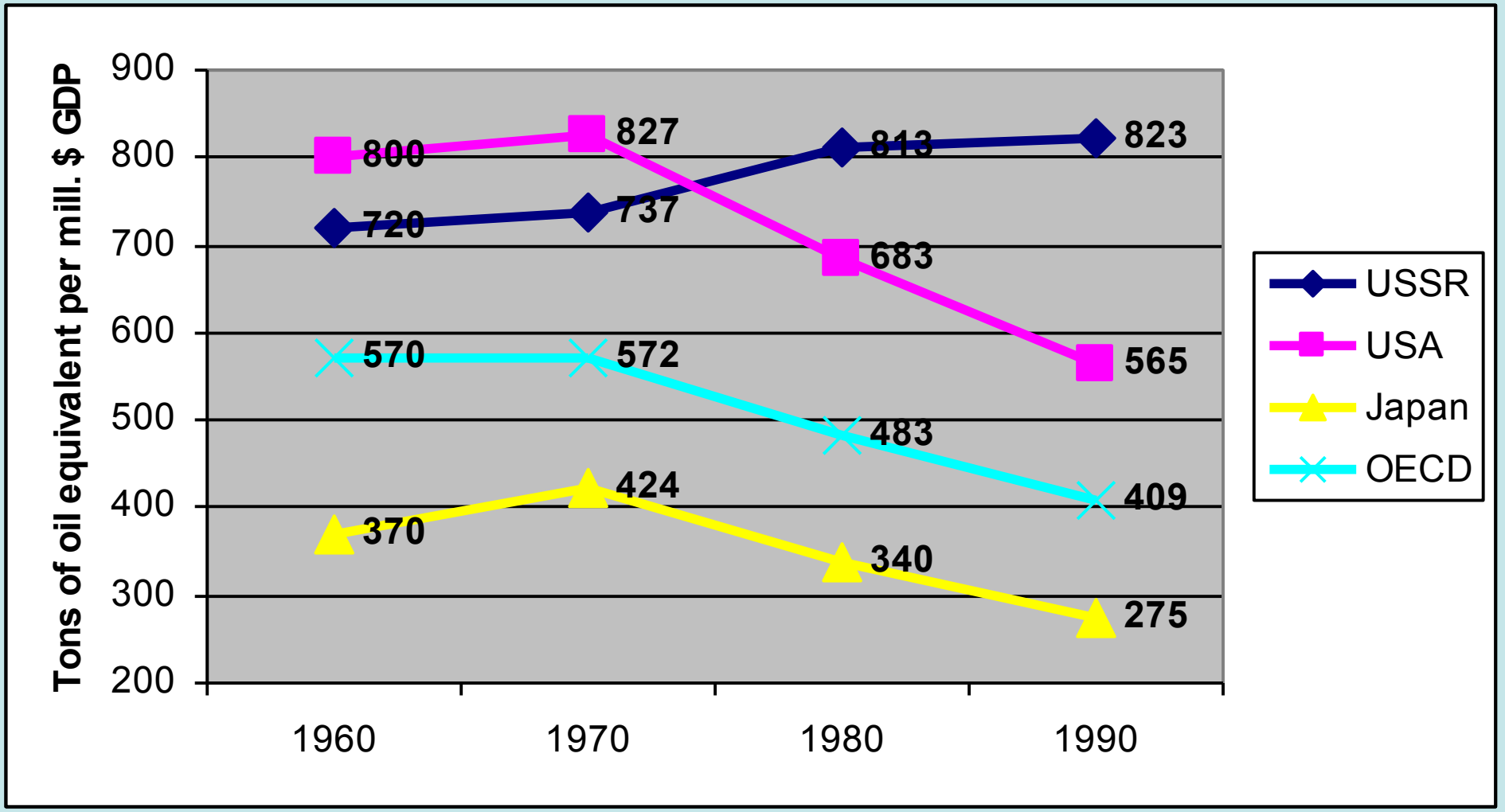
Structural Inefficiencies: Material inputs and inventories, capital productivity and technical progress

- Material inputs and inventories
- Fixed capital stock - decreasing productivity
  - *Data on capital productivity*
  - *Slow retirement - wearing out of capital stock*
  - *Capacity utilization rate*
  - *Growing unfinished construction*
- Technical Progress and capital allocation
  - *R and D and innovations*
  - *Technical progress and the choice of investment alternatives*

High material and energy intensity of Soviet Economy

- USSR used 1.5 times more materials and 2.1 more energy per unit of national income than the US
- The share of material and supplies in the value of gross industrial output was 65-70% as compared to 55-60% in the US
- Produced and consumed 1.5 to 2 times more steel and cement per unit of output than the US
- Domestic machines and machine tools were 15% to 25% heavier than foreign models
- Agricultural production was 15% less than in the US, but used 3.5 times more energy
- Material and energy intensity was increasing

Energy intensity of GDP



Source: Dobozi I. Soviet Energy Policy and Consumption in 1990s:The Need for new Thinking and Price Reform.1991.

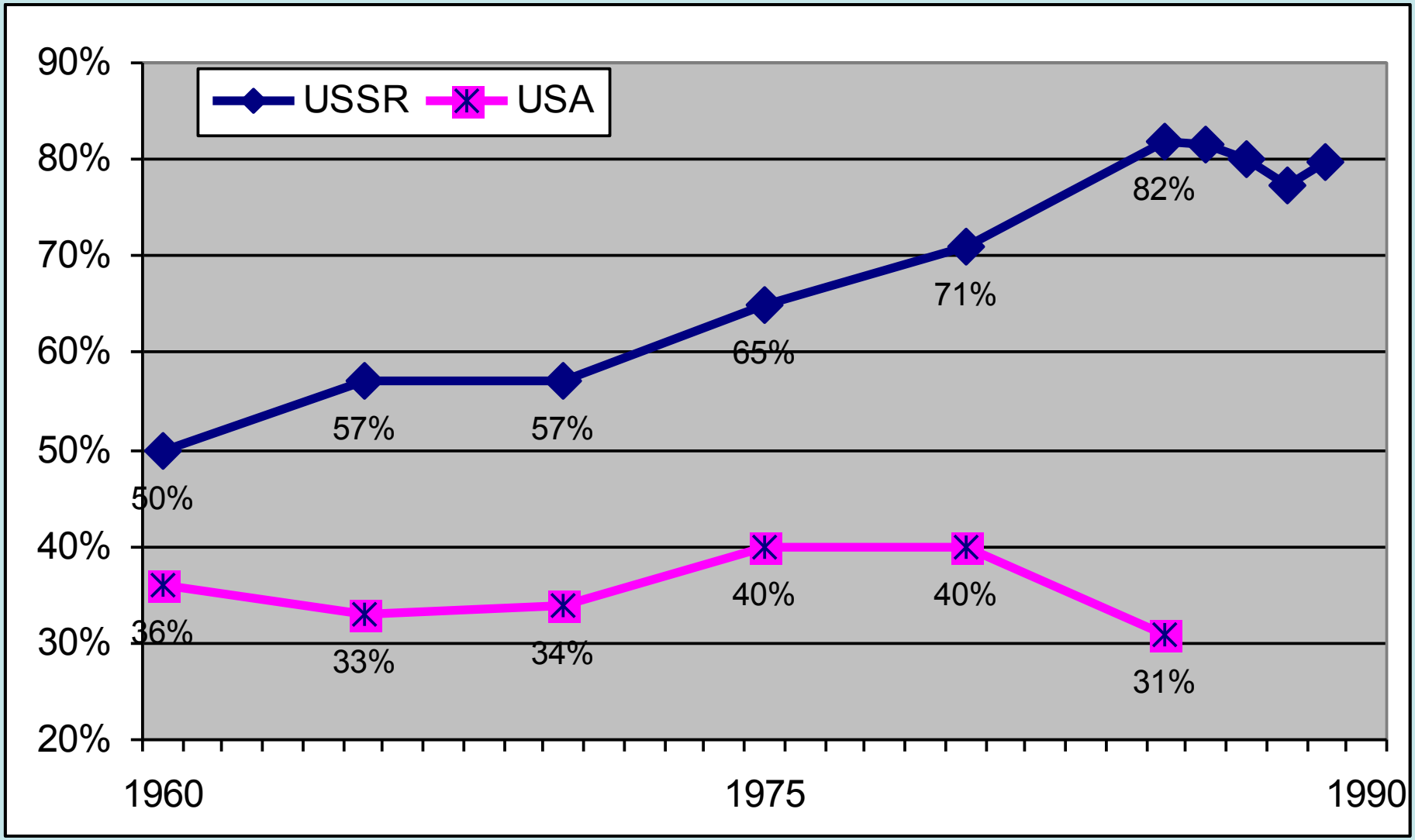
Why was material and capital intensity high and increasing?

- It could be hypothesized that high material intensity was the result of relatively low prices for resources and the lack of stimuli to reduce costs
- However, there were stimuli to increase profits and reduce costs (at least after 1965 reform). Besides, in EE countries, where energy and material prices were close to world levels, energy and material intensity was also high
- But the main criteria of the performance of enterprises in the administrative system was meeting the production quotas, reducing costs was a secondary target
- If there is a conflict between meeting the production quota and cutting costs, managers have always chosen the production quota even at the expense of higher costs

Growth of inventories - natural reaction of enterprises to protect themselves from disruption of supplies

- Huge inventories caused by the inefficient system of rationed supply - centralized allocation of resources
- Inventory to sales ratios - considerably higher in the USSR than in the West
  - In manufacturing - 1.4-1.9 in the US, 2.4 in the USSR
- Inventories in the state enterprises in material production in 1957 comprised 57% of the national income, in 1985 – 460 billion rubles, or 80% of national income
- Inventories in the US ~30% of national income
- Rapid growth of inventories to income ratio in the 1970-80s, as opposed to the stability of this ratio in Western countries
  - *Kanban* system (just-in-time deliveries) introduced in 1972 by Toyota, later widely spread to other industries and countries

Inventories as a % of national income (prior to 1985 for the USSR inventories of collective farms are excluded; after 1985 statistical definition of inventories was changed)

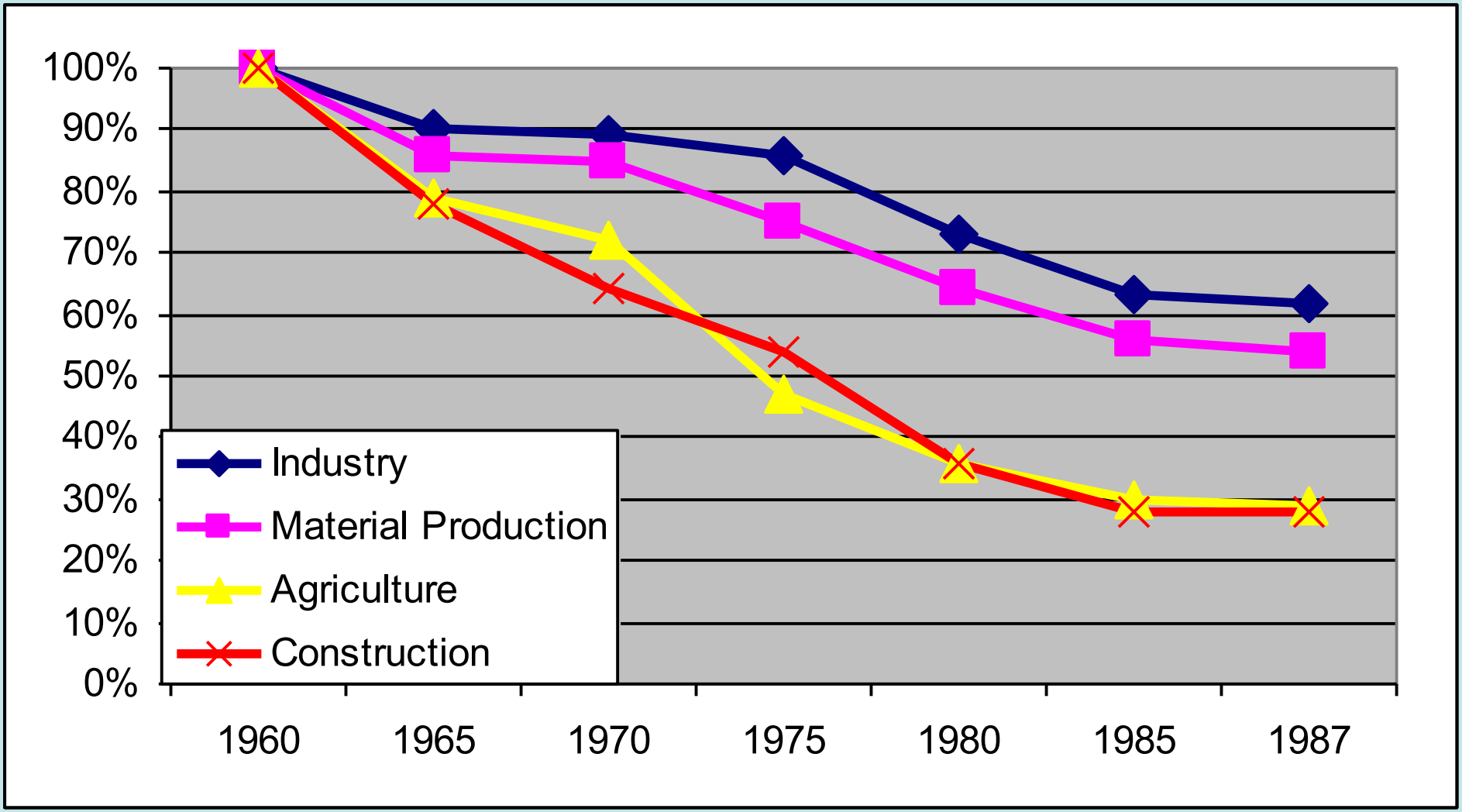


Source: Narodnoye Khozyaistvo SSSR (National Economy of the USSR); Economic Report of the President for various years.

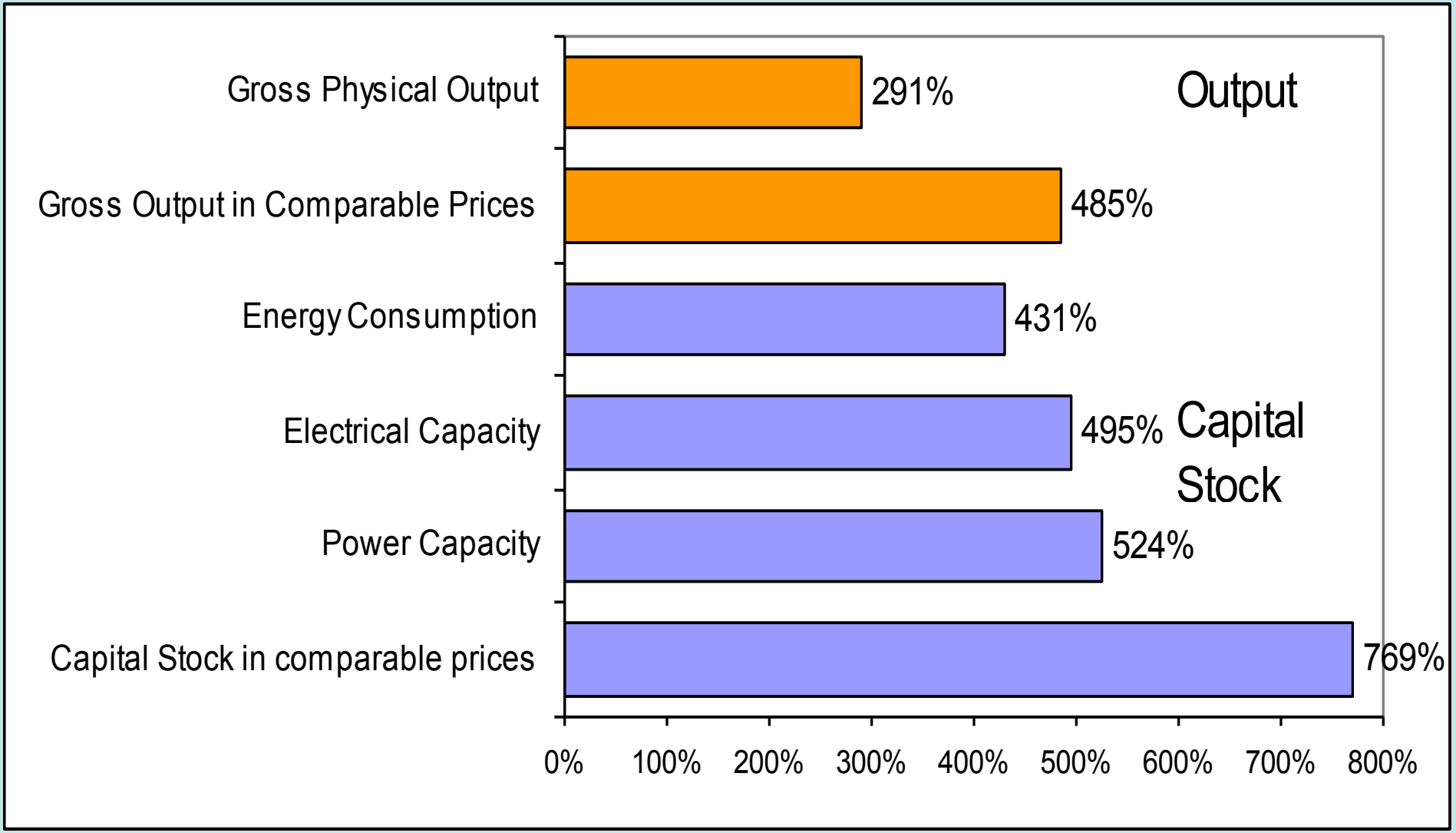
Falling and low capital productivity

- **During the last 25 years of the existence of CPE in the USSR, capital productivity fell almost by a half**
  - **Including 1.5 times in industry and more than 3 times in agriculture and construction**
  - **To compare, in the US capital productivity in the private sector and in manufacturing was relatively stable**
  - **The MCP (*delta Y/delta K* - increase in output/new investment) has fallen especially sharply**
  - **Incremental capital productivity in 1981-85 was 2 times lower than in 1966-1970**
- **Measurement issues**
  - **Data on the growth of output and capital in constant prices may be deceptive**
  - **Use of physical indicators gives a more accurate sense of the scale of changes in capital productivity**

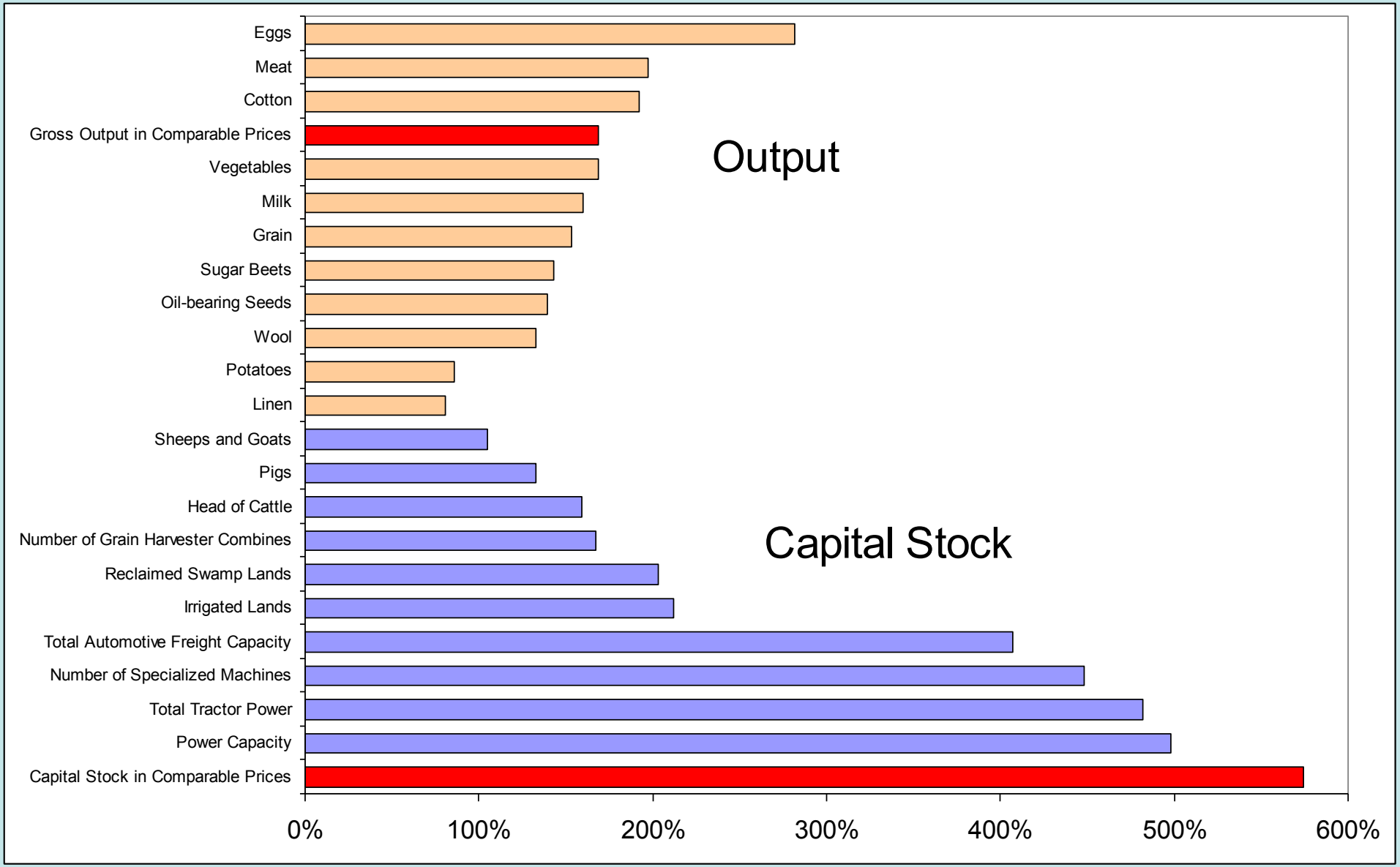
Capital productivity, 1960=100%



Growth rates of capital stock and output in industry,1960-85,%



Growth rates of capital stock and output in agriculture,1960-85,%



Capital productivity in agriculture and industry

- In agriculture during the period 1960-1985 capital stock grew twice as fast as output - capital productivity fell, but not as much as official statistics suggests (capital in constant prices is overstated more than output)
- In industry capital productivity declined as much as official statistics suggests - by some 40%
  - This decline only partially can be offset by increased labor productivity due mechanization

Capital productivity in construction

- **Less new production capacities has been put into operation**
  - **In the 1980s the construction of factories (in capacity terms measured in physical units) decreased as compared to the 1960s**
  - **Despite the fact that capital investment in constant prices increased constantly**
- **Between the 1960s and the 1980s, the volume of housing construction (in square m of living space) increased only slightly**
- **No increase in the construction of social facilities (measured in physical units - capacity of hospitals, schools, etc.)**
- **At the same time (over the period 1960-85) the capital stock has grown**
  - **Number of excavators, scrapers, bulldozers, cranes grew by 3 to 5 times**
  - **The share of mechanized labor has grown steadily**
- **Therefore, the real capital productivity fell by 70-80% over 25 years**
- **Labor productivity in construction has not increased**

Industrial capacities put into operation, annual averages

Capacities for the production of:	1971-75	1976-80	1981-85	1986-89
Synthetic fibres - total, thousand tons	69.9	52.6	65.5	17.1
- reconstruction, % of total	19	26	42	27
Plastic masses - total, thousand tons	196	301	241	116
- reconstruction, % of total	11	7	5	17
Lumber - total, mill.m^3	1.1	0.9	0.6	0.3
- reconstruction,% of total	15	18	17	7
Reinforced concrete products - total, mill.m^3	5.9	5.1	4.5	4.6
- reconstruction, % of total	14	16	21	24
Ready made clothing - total, mill. pieces	32.5	12.7	36.1	27.9
- reconstruction, % of total	6	15	10	10
Socks and panties - total, mill. pairs	6.5	8.8	39.8	38.4
- reconstruction, % of total	62	45	7	0
Shoes - mill. pairs	13.5	4.3	5.3	13.4
- reconstruction, % of total	11	35	47	18
Soft leather - total, mill.dm^2	541	309	223	443
- reconstruction,% of total	0	0	19	0

Capacities for the production of:	1971-75	1976-80	1981-85	1986-89
Coal - total, mill. tons	22.8	18.1	12.3	23.8
- due to reconstruction of existing enterprises, % of the total	22	27	36	17
Iron ore - total, mill. tons	26.3	26.8	13.7	3.2
- reconstruction, % of total	3	3	25	5
Steel - total, mill. tons	2.2	2.9	1.4	1.2
- reconstruction, % of total	50	39	36	0
Rolled metal - total, mill. tons	2.4	1.5	1.5	1.2
- reconstruction, % of total	4	7	27	33
Steel pipes - total, mill. tons	477	378	143	306
- reconstruction, % of total	21	27	12	56
Electrical generators - total, thousand KWT	1120	610	1006	635
- reconstruction, % of total	29	54	57	98
Sulphur acid - total, mill. tons	1.7	1.9	1.1	0.8
- reconstruction, % of total	5	4	14	50
Calcinated sodium - total, thousand tons	15	30	60	73
- reconstruction, % of total	15	30	60	73

Average annual growth rates of Soviet GNP, inputs and productivity, CIA data, %

Period	1961-65	1966-70	1971-75	1986-80	1981-84	Weights
GNP	5.0	5.3	3.7	2.6	2.7	-
Total inputs	4.5	4.1	4.2	3.5	3.0	-
- Labor (man-hours)	1.6	2.0	1.7	1.1	0.8	0.56
- Capital	8.8	7.4	8.0	6.9	6.3	0.41
- Land	0.6	-0.3	0.8	-0.1	-0.2	0.03
Total factor productivity	0.5	1.2	-0.5	-0.9	-0.3	-
- Labor (man-hours)	3.4	3.2	2.0	1.5	1.9	-
- Capital	-3.5	-2.0	-4.0	-4.0	-3.4	-
- Land	-4.4	5.6	2.9	2.0	2.8	-

Source: *Handbook of Economic Statistics, 1985: A Reference Aid.* CIA, Sept. 1985, p. 68.

Why capital productivity was so low

- Slow retirement of fixed capital stock - the CPE was programmed to invest into the expansion of capacities rather than into the restructuring of existing capacities
- Capacity utilization rate was low and falling
  - In the US, this indicator ranged from 70 to 90%, exceeding 85% only in the most prosperous years
  - In the USSR it was probably at 2/3-3/4 level
- Long construction periods, huge unfinished construction

Low retirement rate, high investment into expansion of capital stock

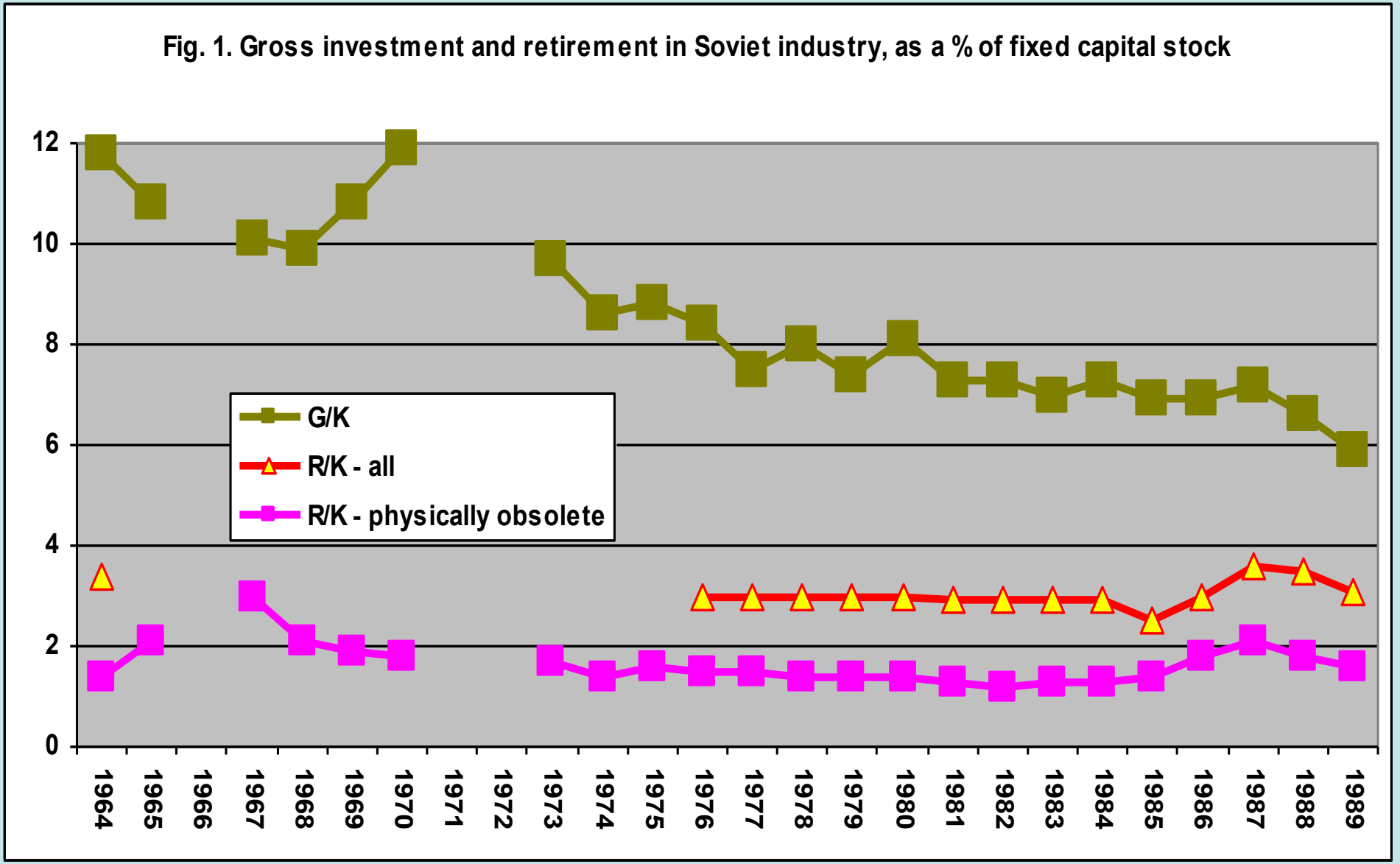
- In agriculture, equipment was taken out of service quickly
  - Even too quickly
- In all other sectors, capital stock was replaced very slowly
  - Average service life of capital stock in USSR: 30-50 years, in US: 20-25 years
- From 40 to 50% of all depreciation went to capital repair

Age characteristics of equipment in Soviet industry

Years	1970	1980	1985	1989
Share of equipment with an age of: - less than 5 years	41.1	36.0	33.7	31.6
- 6-10 years	29.9	28.9	28.5	28.6
- 11-20 years	20.9	24.8	25.5	26.2
- over 20 years	7.8	10.3	12.3	13.7
Average age of equipment,years	8.3	9.31	9.91	10.32
Average service life, years	24.0	26.9	27.9	26.2
Accumulated depreciation as a % of gross (initial) value of capital stock	26	36	41	45

Source: *Narodnoye Khozyaistvo SSSR* (National Economy of the USSR) for various years.

Retirement in Soviet industry was low



Investment into replacement of retirement as compared to investment into expansion of capital stock

- Since machinery was replaced slowly, the lion's share of all investment was used to expand capital stock, not to replace worn-out equipment
  - At the beginning of 1980s, only 25% of capital investments (in non-residential construction projects) went to technical upgrading of existing factories
  - In the US, only 35 to 55% of all investment went into expansion of capital stock; the remainder – for replacement
- Temporary shutdown for technological upgrading may cause non-fulfillment of the plan
  - So usually planner chose to build a new plant and/or expand existing capacities instead of renovating them

Capacity utilization rate

- Statistics overstated the level of utilization of production capacities because
  - Capacity utilization rate was measured only in the mainstream production
  - Production capacities calculated at the bottleneck
  - Statistics was based on “passport capacity”, which was usually understated
- Low shift coefficient in Soviet industry
  - 1.54 in 1960 to 1.42 in 1970, to 1.37 in 1980, and to 1.35 in 1985 (Narkhoz, various years).

Capacity utilization rate in Soviet industry, %

Years	**1970**	**1971**	**1975**	**1978**	**1980**	**1982**
Faltsman's estimate (130 types of capacities)		92	93		88	86
Valtukh's and Lavrovskiy's estimate - 130 types of capacities	90.0	90.6	91.5	90.3	87.2	85.3
- 250 types of capacities					85.7	83.9
Official data, non-weighted average - 23 types of capacities			91.1		87.1	
- 29 types of capacities					87.3	

Years	**1983**	**1985**	**1986**	**1987**	**1988**	**1989**
Falt**sman's estimate** (130 types of capacities)						
Valtukh's and Lavrovskiy's estimate - 130 types of capacities	85.6					
- 250 types of capacities	84.5					
Official data, non-weighted average - 23 types of capacities		87.8	88.3	87.5		
- 29 types of capacities		87.9	88.3	87.4	87.9	87.2

Source: *Voprosy Economiki,*1985, N3, p. 47; *EKO*, 1986, N2, p. 20; *Narodnoye Khozyaistvo SSSR* (National Economy of the USSR) for various years.

Capital investment, capital stock put into operation, unfinished construction and construction periods

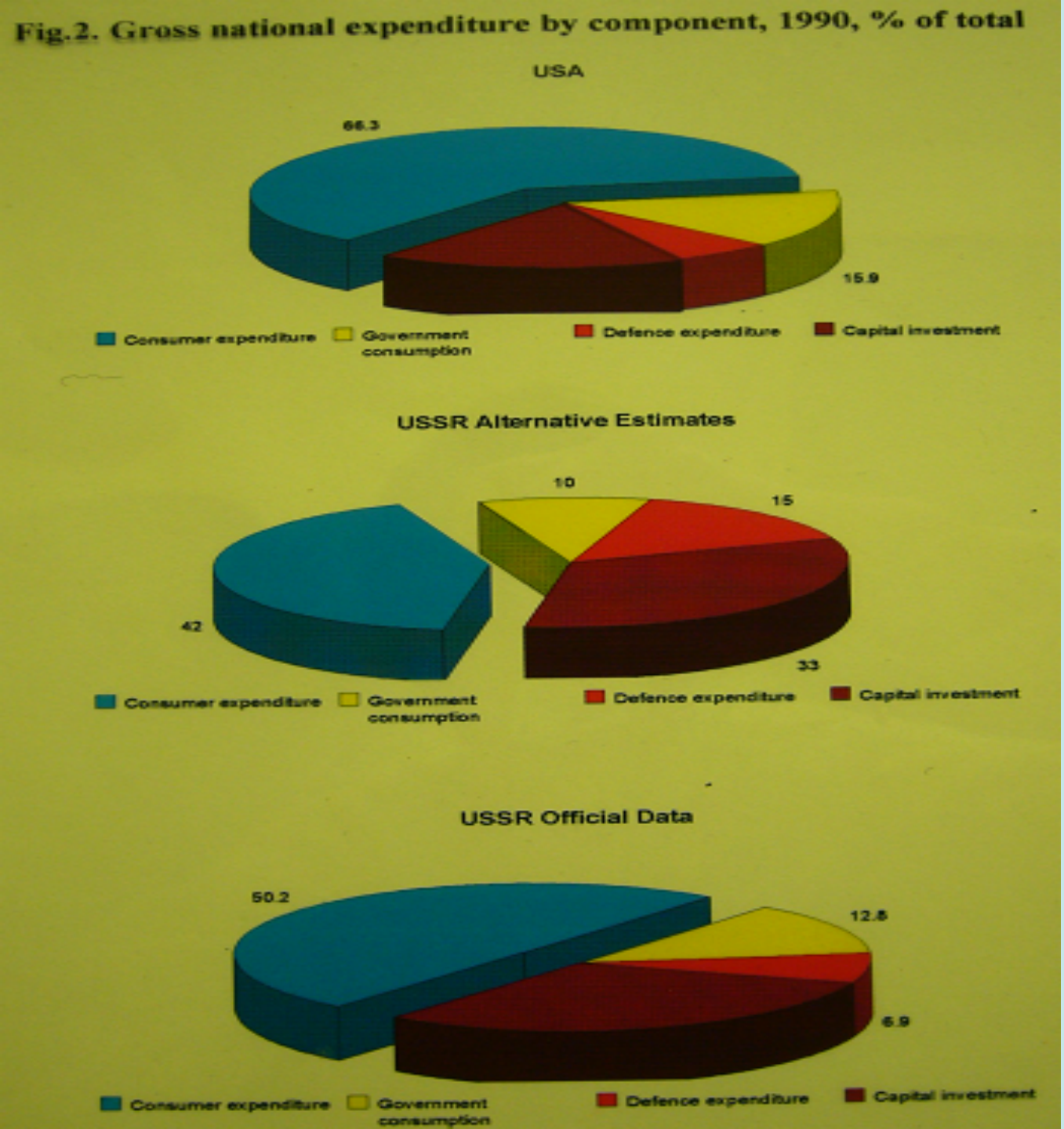
Period, year	1961-65	1966-70	1971-75	1976-80	1981-85	1986-89	1989
Capital investment, bill. rubles - total	279.3	398.4	562.8	717.7	843.2	846.5	228.5
- industrial	101.9	139.7	196.0	251.4	300.7	311.2	85.7
Capital stock put into operation - total	261.9	365.2	526.3	667.5	815.8	767.7	197.4
- industrial			175.1	226.4	282.1	264.7	70.0
Ratio of capital stock put into operation to capital investment, % - total	94	92	94	93	97	91	86
- industrial			89	90	94	85	82
Unfinished construction as a % of capital investment, end of the period		73	75	87	79	91	91
Construction period - actual, years					9.5*	8.1	8.2
- as a % of normative construction period					310	280	280

* 1985

Gross national expenditure by component, % of total, 1989

COMPONENT	COUNTRY		
	USSR, official data	USSR, alternative estimates	USA
Personal expenditure on consumer goods & services	48.1	40-45	66.3
Government expenditure on goods & services (without capital outlays)	20.8	20-25	15.9
- Non-defense	12.7	5-10	9.8
- Defense	8.1	10-15	6.1
Gross capital investment	31.1	35	19.4
Net exports and statistical discrepancy	-	-5 - +5	-1.6

Source: *Narodnoye Khozyaistvo SSSR* (National Economy of the USSR); *Economic Report of the President.*



Defense and investment spending accounted for nearly 50% of Soviet GDP, but only for ¼ of the US GDP

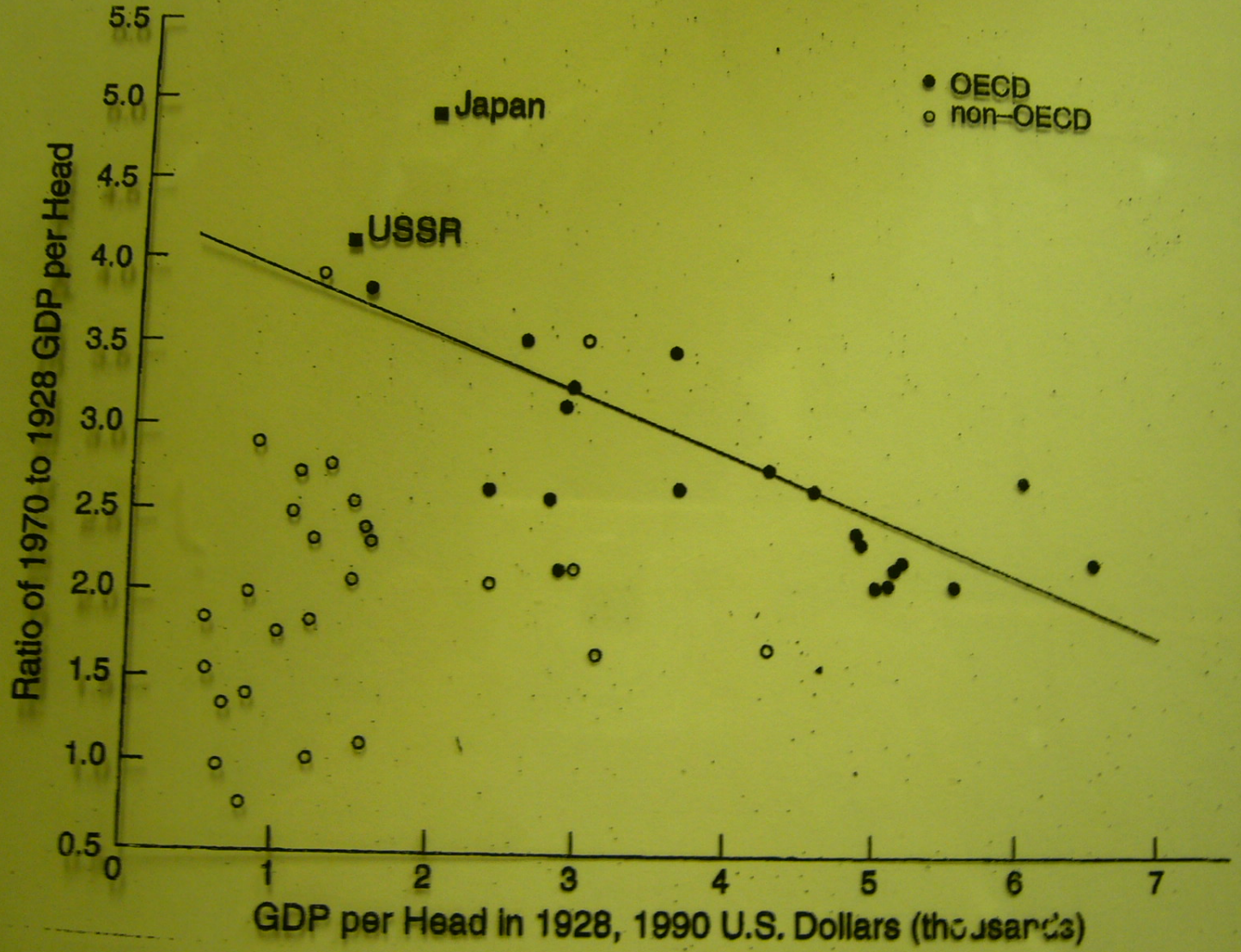
R&D expenditures and personnel

Years	1980	1985	1989
R&D expenditure - total, bill.rubles	22.3	28.6	43.6
- as a % of GNP	3.5	3.7	4.7
Military R&D expenditure financed through the government budget - total, bill.rubles	-	-	15.3
- as a % of GNP	-	-	1.7
R&D employees - total, thousand	1373	1491	1522
- in the Academy of Science of the USSR, republican and other Academies, % of total	9.2	9.2	9.9
- in research institutes of branch ministries, % of total	43.6	43.7	42.2
- in universities, archives, libraries, museums and similar organizations, % of total	36.7	35.3	36.1
- in other organizations, % of total	10.6	11.7	11.8

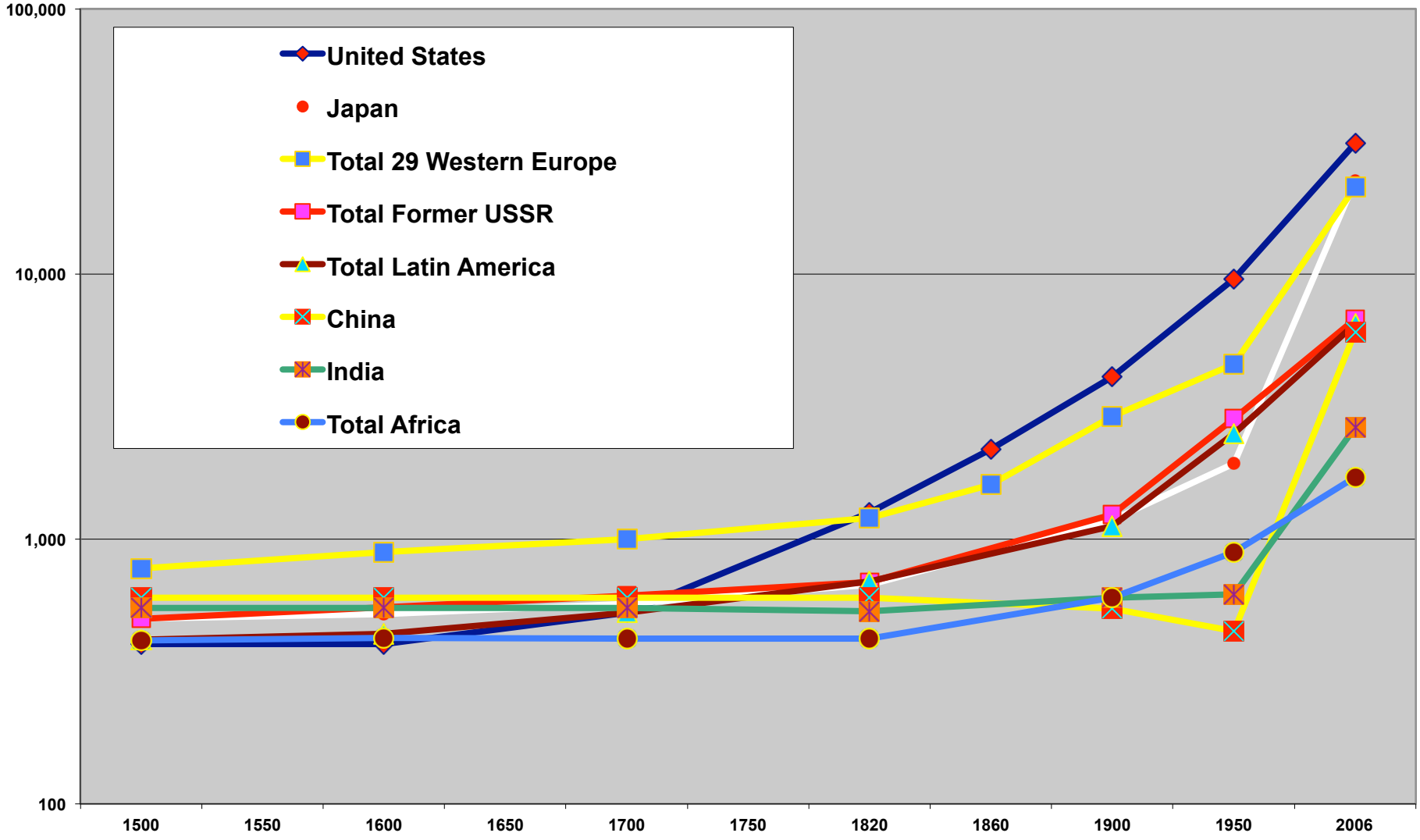
Source: *Narodnoye Khozaistvo SSSR* (National Economy of the USSR) for various years.

Figure 1

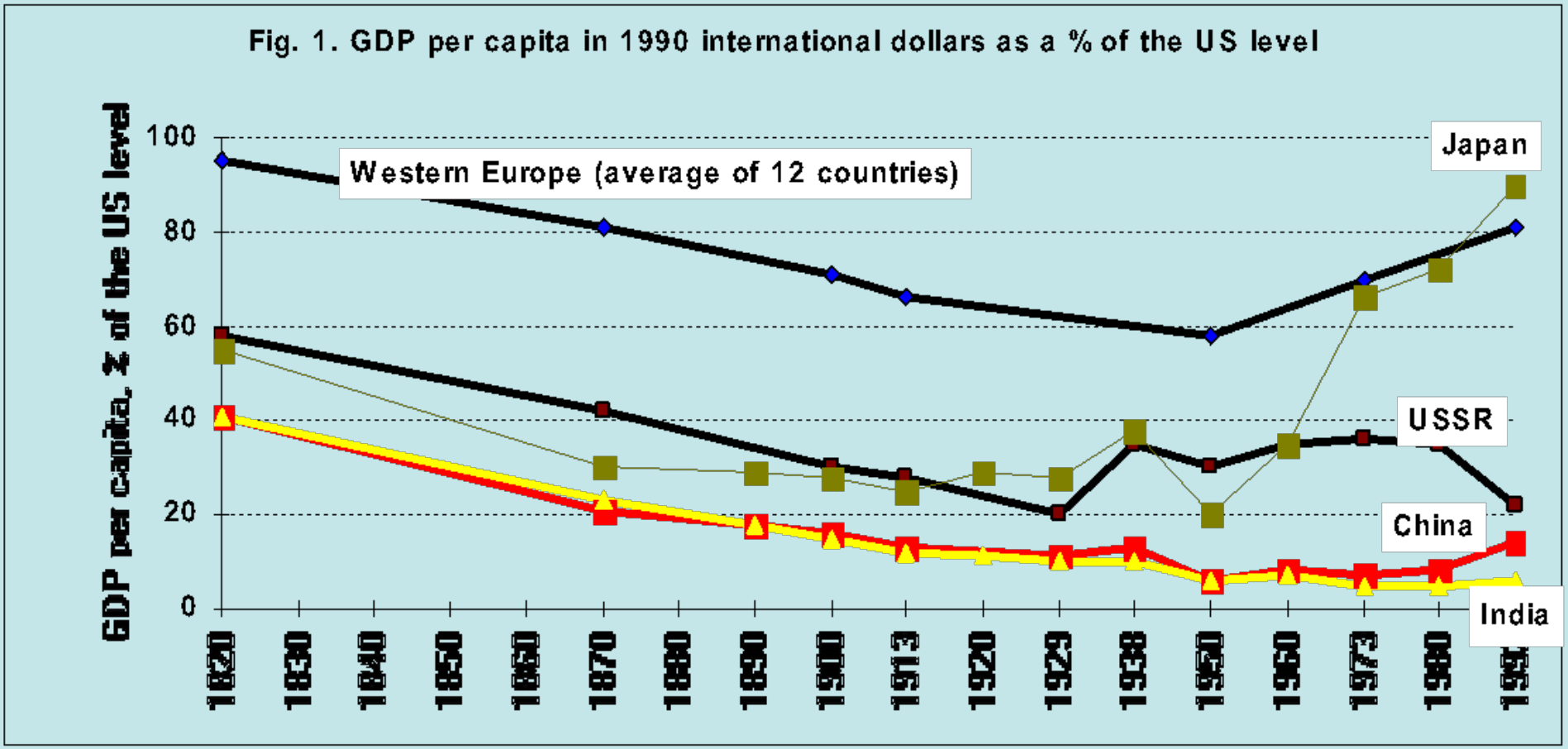
Economic Growth, 1928-1970



PPP GDP per capita in major countries and regions since 1500, 1990 international Geary-Khamis dollars; source: A. Maddison; log scale)

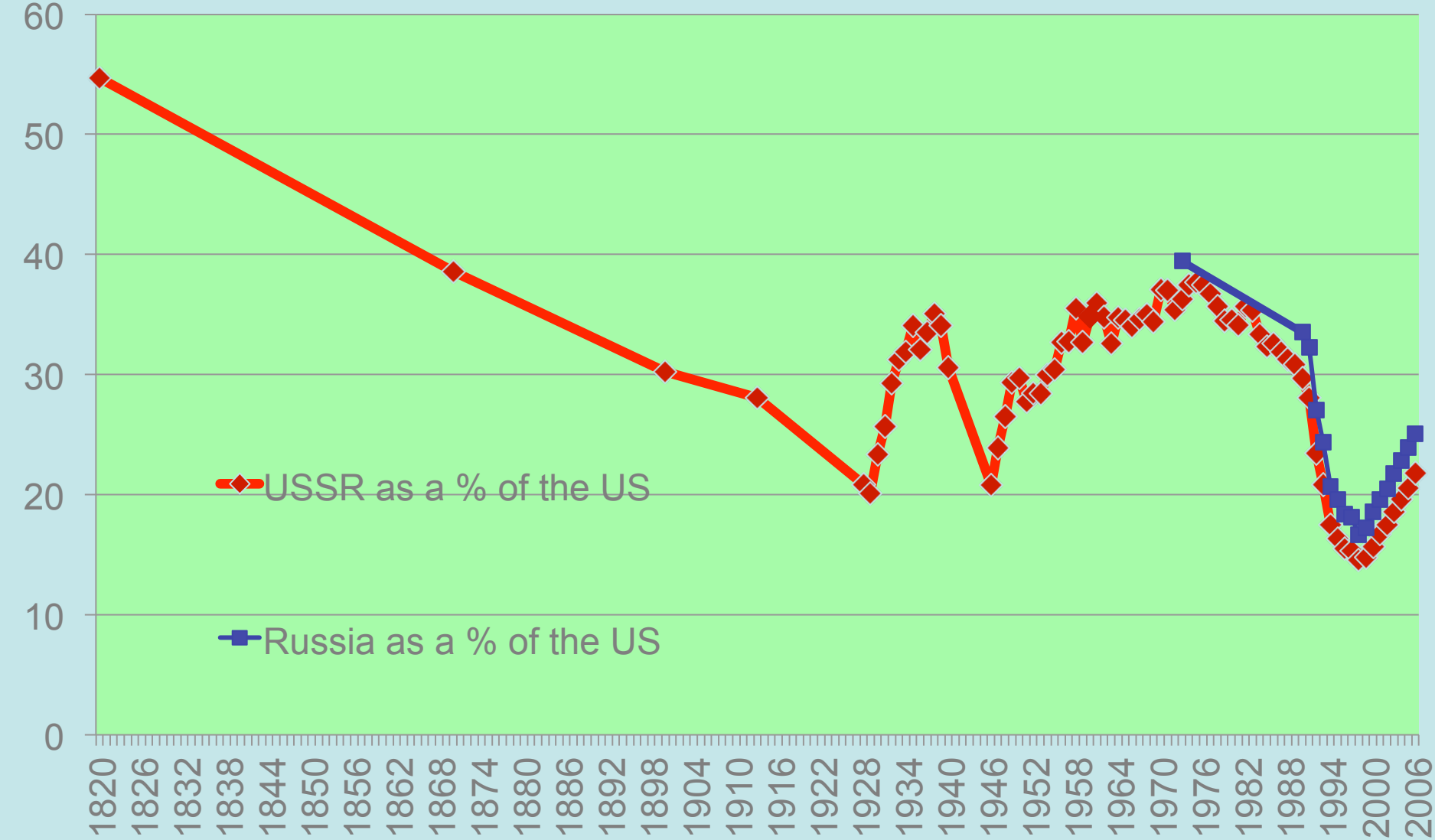


Catch up development: only Japan (+Korea, Taiwan, HK, Singapore) managed to reach the level of GDP per capita of developed countries

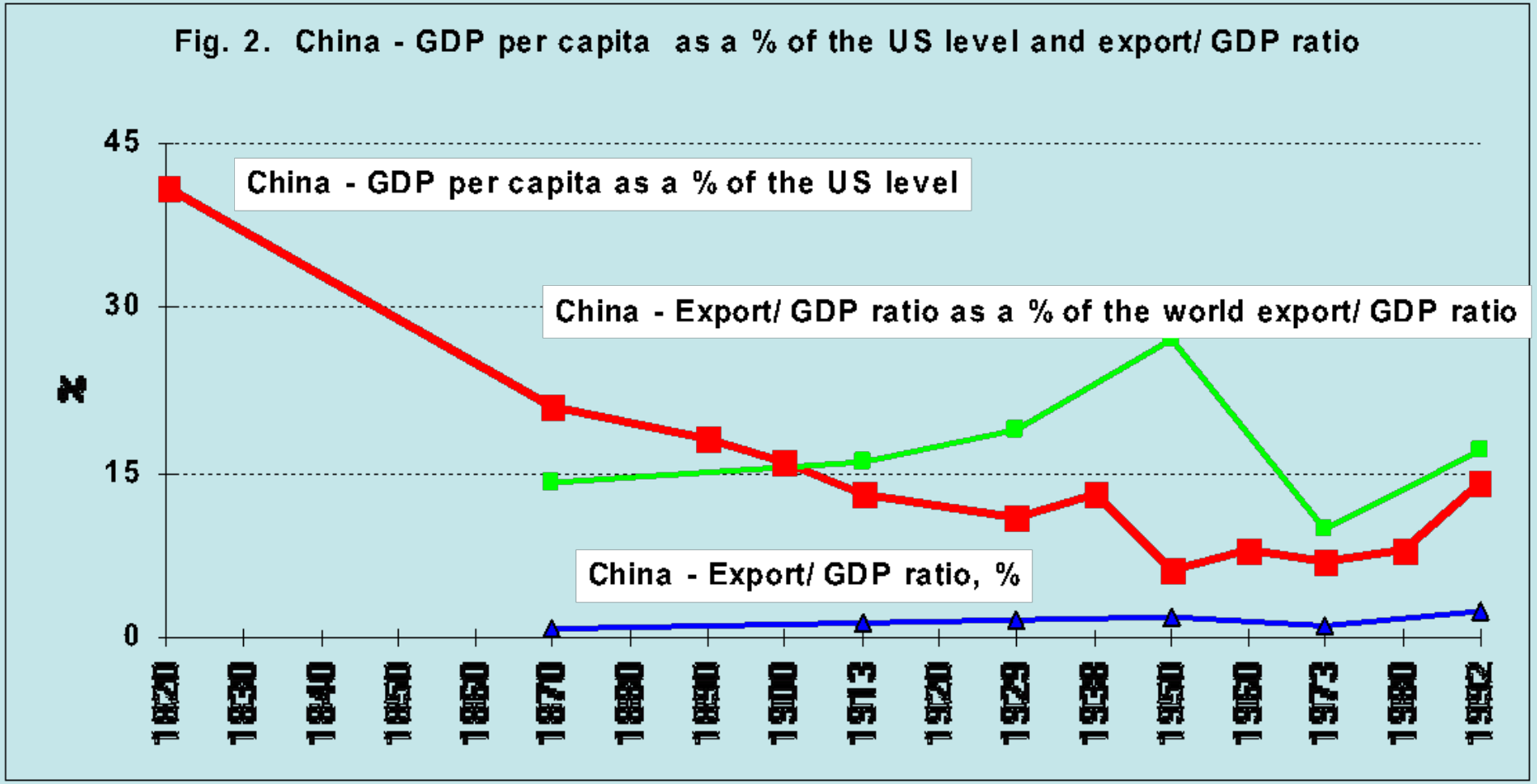


Source: Maddison 1995.

GDP per capita in the USSR and Russia, % of the US level (source: A. Maddison,



China is also catching up since 1950



Source: Maddison 1995.

Table 1. Growth in the USSR and Asian economies, Western data, 1928-87 (average annual percent)

Period/ country	Output per worker	Capital per worker	Capital/ output ratio	TPF growth (unit elasticity of substitution)	TPF growth assuming 0.4 elasticity of substitution
USSR (1928-39)	2.9	5.7	2.8	0.6	
USSR (1940-49)	1.9	1.5	-0.4	1.3	
USSR (1950-59)	5.8	7.4	1.6	2.8	1.1
USSR (1960-69)	3.0	5.4	2.4	0.8	1.1
USSR (1970-79)	2.1	5.0	2.9	0.1	1.2
USSR (1980-87)	1.4	4.0	2.6	-0.2	1.1
Japan(1950/57/65/-85/88/90)			2.3 - 3.2	1.7 - 2.5	
Korea (1950/60/65-85/88/90)			2.8 – 3.7	1.7 - 2.8	
Taiwan (1950/53/65-85/88/90)			2.6 – 3.1	1.9-2.4	

Source: Easterly, Fisher, 1995.

Why MCP was low in a CPE?

-"The Soviet economic growth is the best ever illustration of the Solow model" (M. Weitzman)

- Low elasticity of substitution of labor for capital

Growth rate = Accumulation rate * MCP

$$\frac{\Delta Y}{Y} = \frac{I}{Y} * \frac{\Delta Y}{I}$$

1920s	20%	13%	**20/13**
1930s	10%	26%	**10/26 = 20/52**