Demographic Dividends and National Transfer Accounts

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The Issues

- How will changes in age structure over the demographic transition affect the macro economy?
- How are macroeconomic outcomes influenced by
  - the economic lifecycle
  - the economic support system
- What policies should be pursued?

Results

- Changes in population age structure have important implications for economic performance.
- Population aging may lead to substantial increases in income and wealth.
- Avoiding excessive reliance on public and familial transfer programs is critical.
- Large regional shifts in the size of Asia-Pacific economies seems highly likely.

Outline

I. The Consumption Identity
II. The Support Ratio
III. The first demographic dividend – the benefit of a population concentrated at the working ages
IV. The second demographic dividend – the benefit of a population concentrated at old ages
V. Concluding remarks

I. The Consumption Identity

Consumption per effective consumer

Output per effective producer

$$\frac{C(t)}{N(t)} \equiv c(t) \frac{Y^l(t)}{L(t)} \frac{L(t)}{N(t)}$$

Consumption as a fraction of labor income

Support ratio: effective producers per effective consumer

In Growth Terms

$$gr\left[\frac{C(t)}{N(t)}\right] \equiv gr\left[c(t)\right] + gr\left[\frac{Y^{l}(t)}{L(t)}\right] + gr\left[\frac{L(t)}{N(t)}\right]$$

where $gr[\ ]$ is the growth rate.

II. The Support Ratio

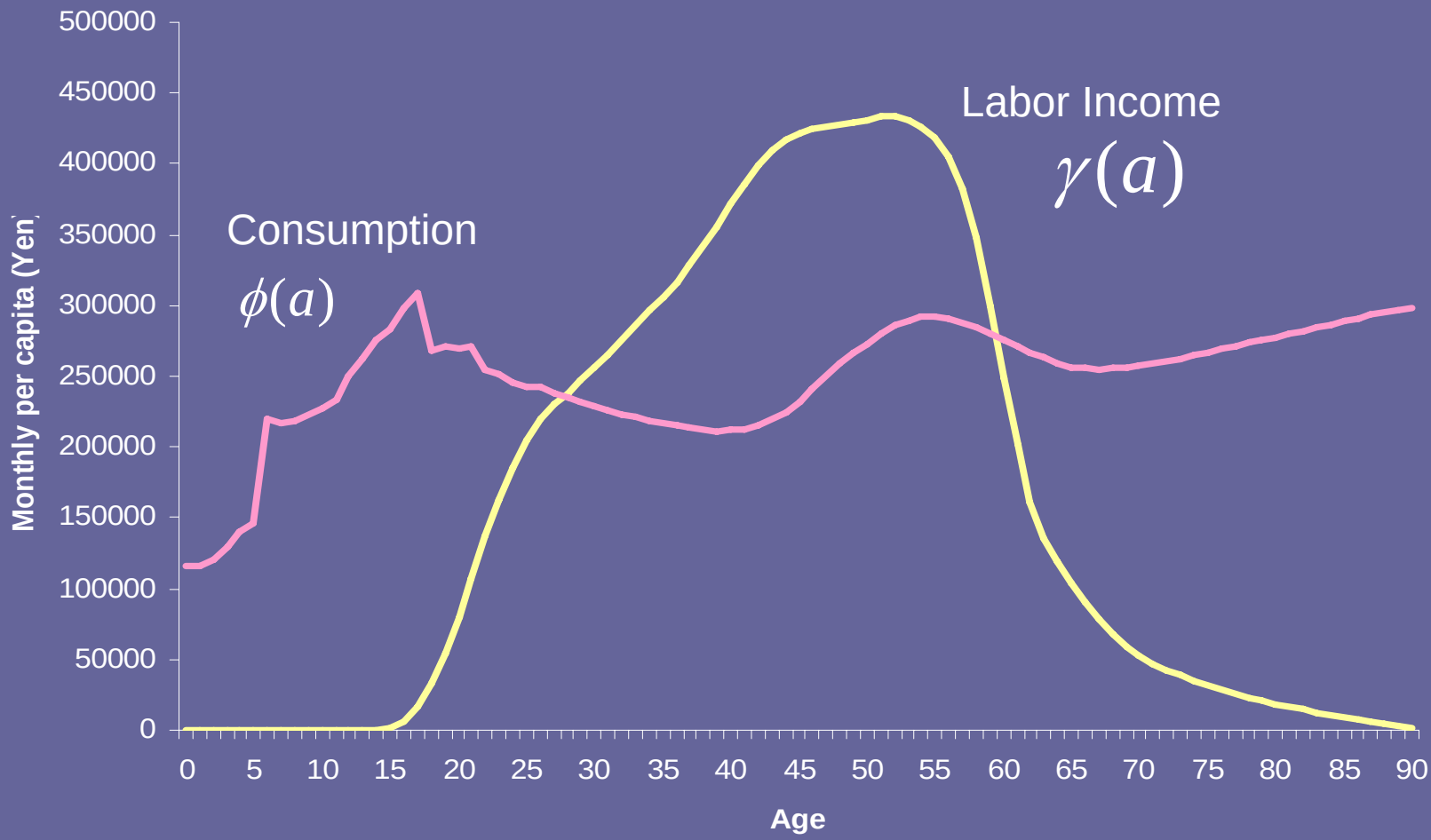
$$\frac{L(t)}{N(t)} = \frac{\sum_{a=0}^{\omega} \gamma(a) P(a,t)}{\sum_{a=0}^{\omega} \phi(a) P(a,t)}$$

$\gamma(a)$ - productivity age profile

$\phi(a)$ - consumption "needs" age profile

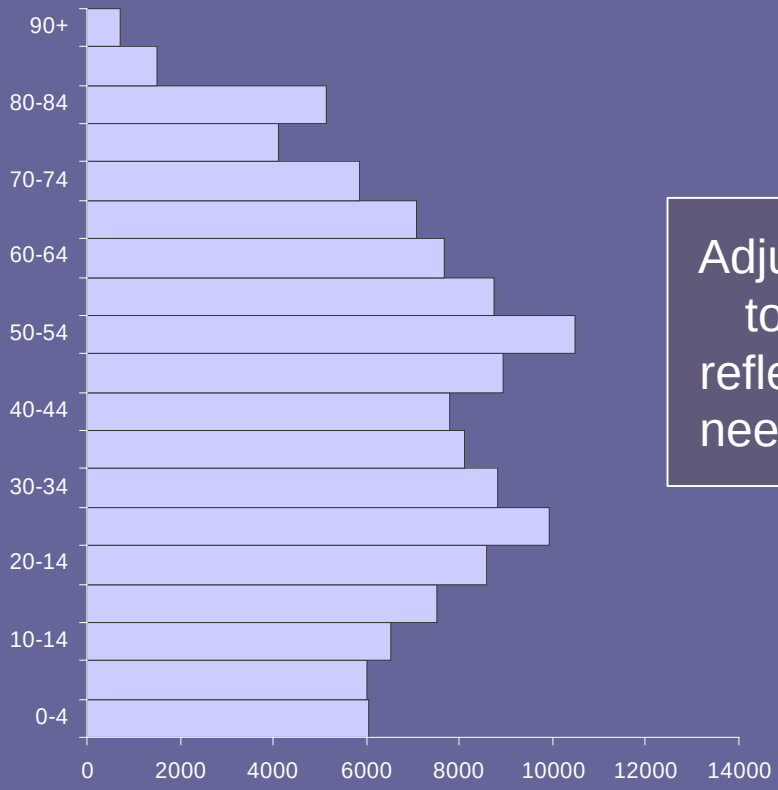
$P(a,t)$ - population

Japan's Economic Lifecycle, 1999



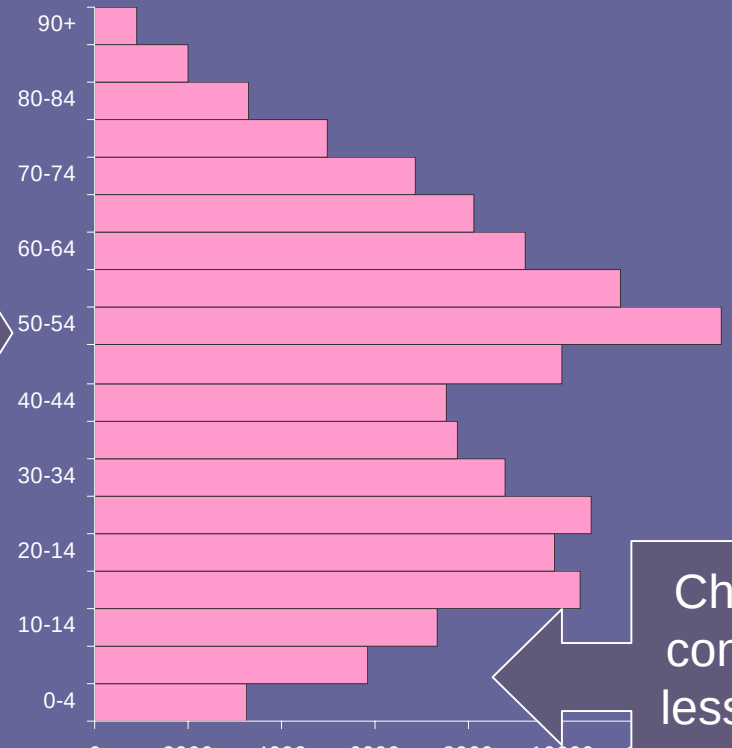
Transforming people into consumers

Population of Japan, 2000



Adjust to reflect needs

Effective Consumers in Japan, 2000



Children consume less than adults

August 22, 2006

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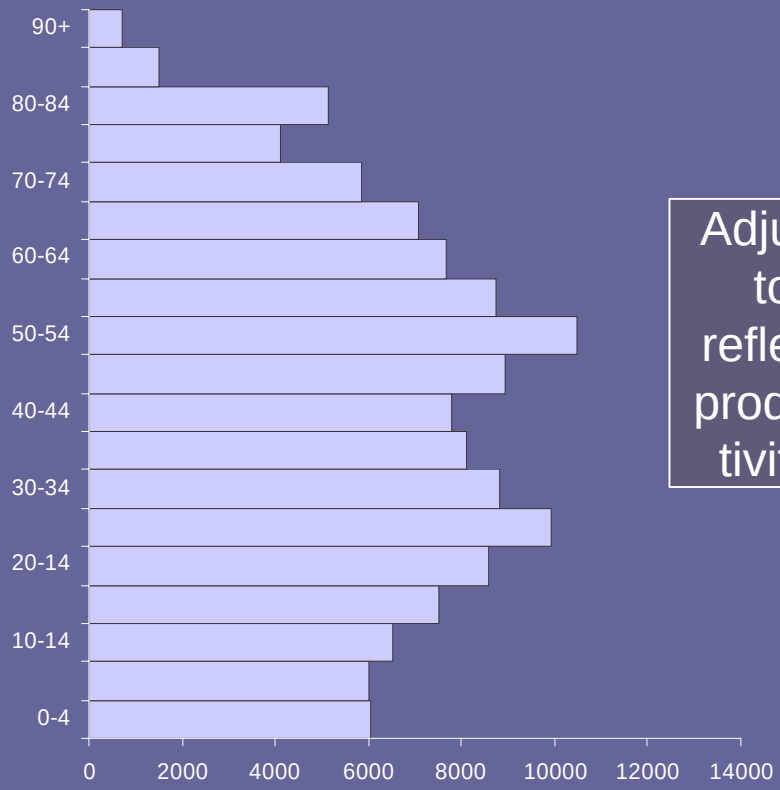
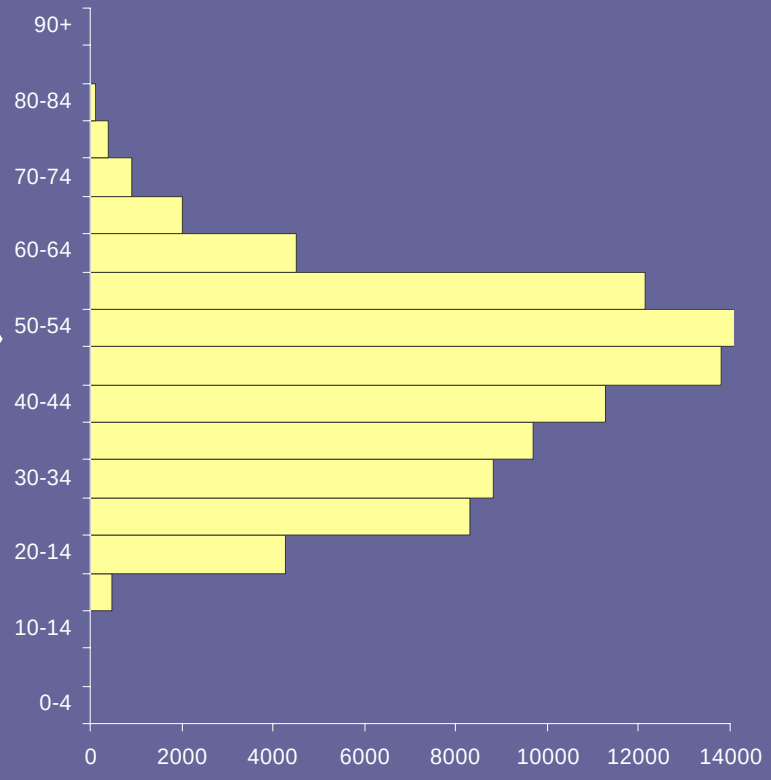
Transforming people into producers

Population of Japan, 2000



Adjust to reflect productivity

Effective producers in Japan, 2000



Japan's Age Structure Transition 1950-2050

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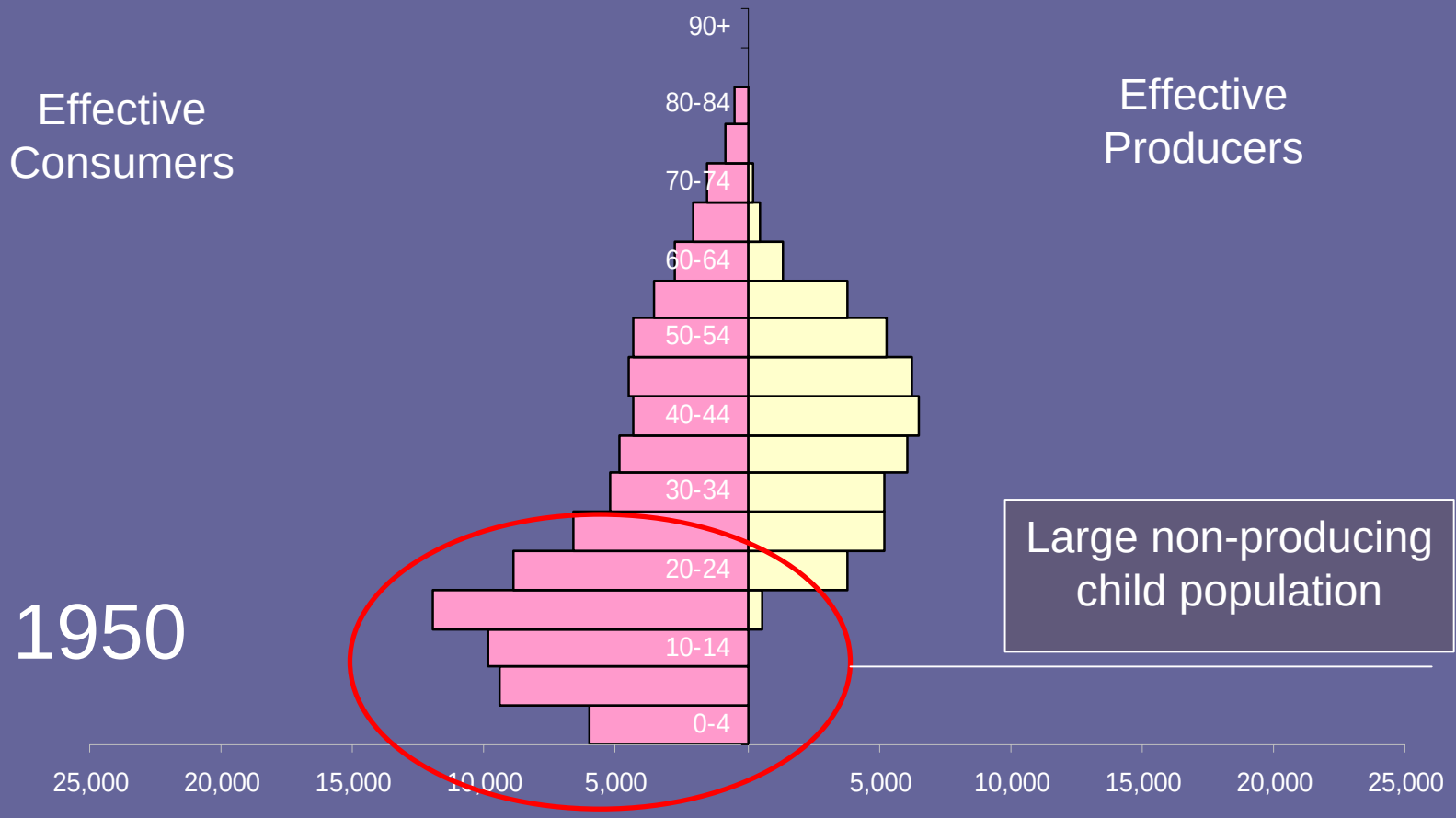
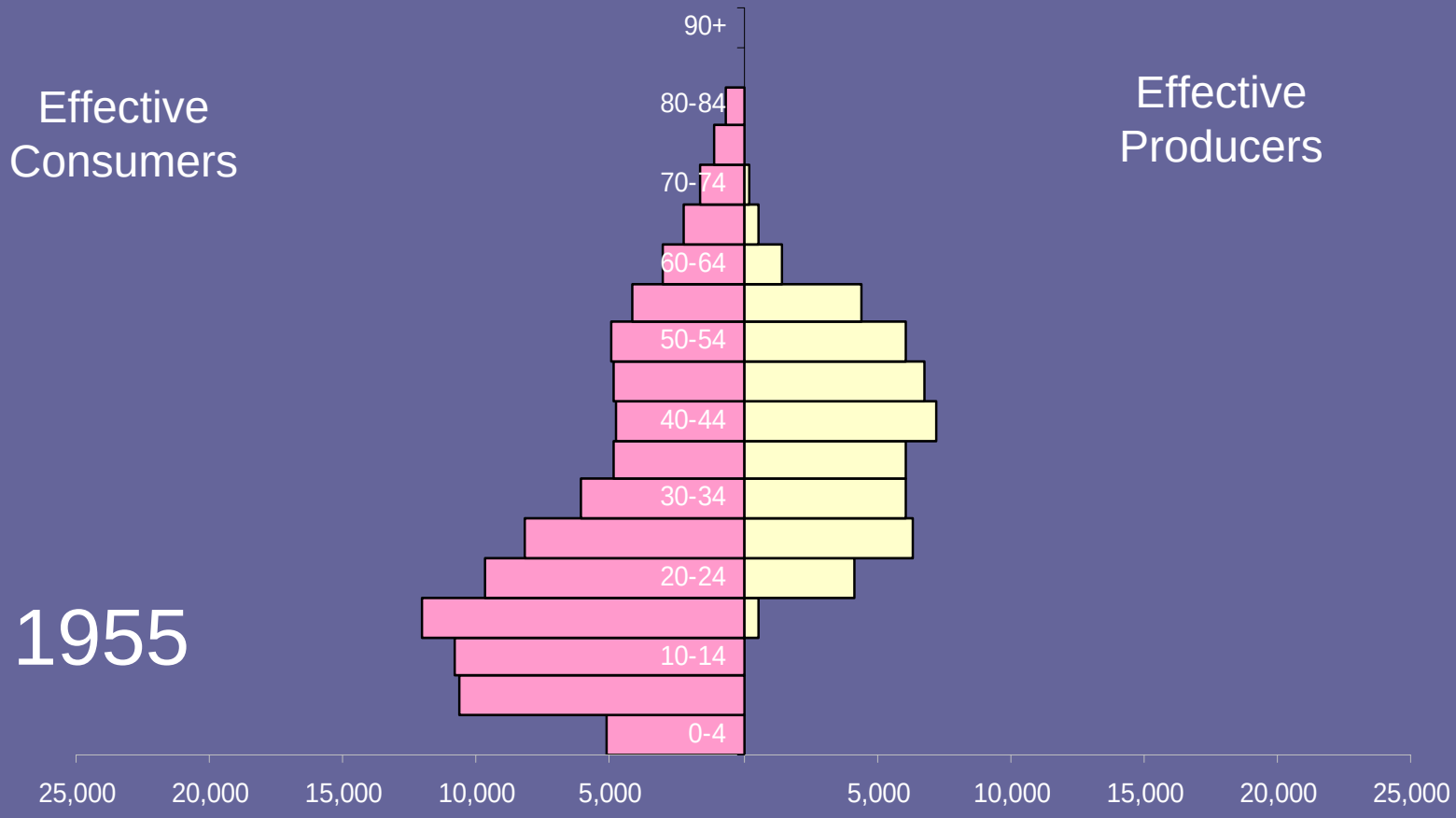
Effective number of consumers and producers by age



Effective number of consumers and producers by age



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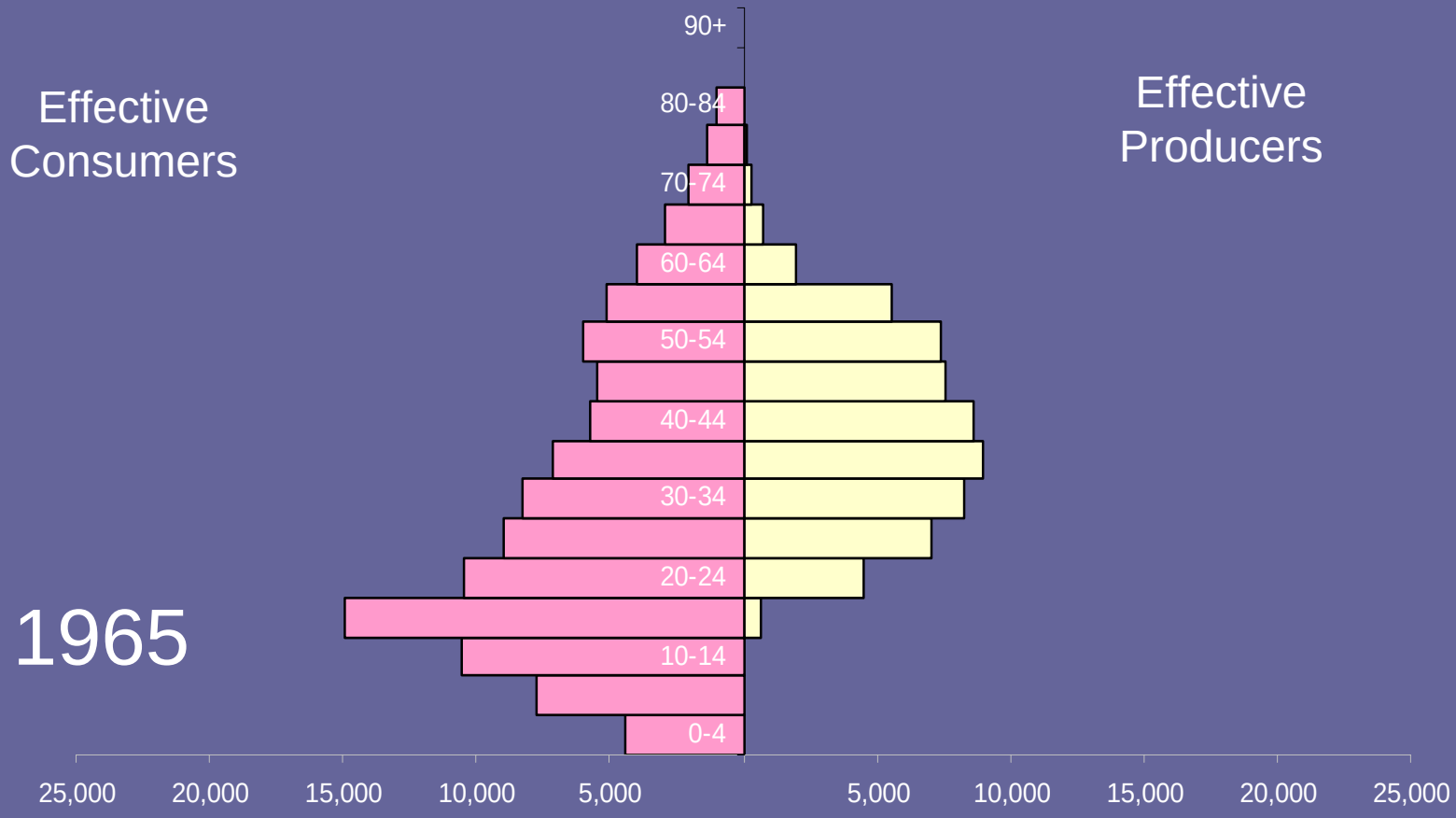

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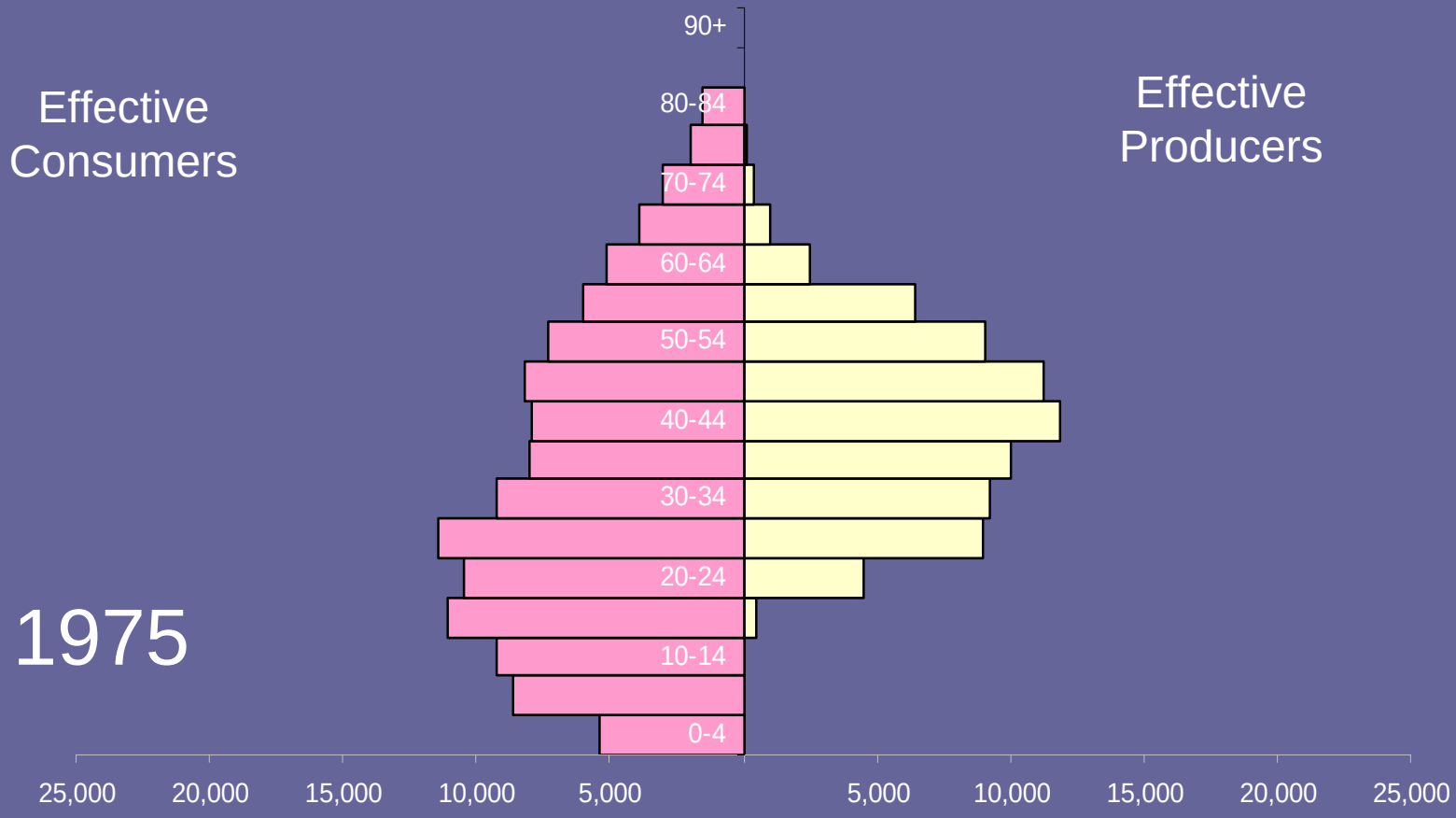

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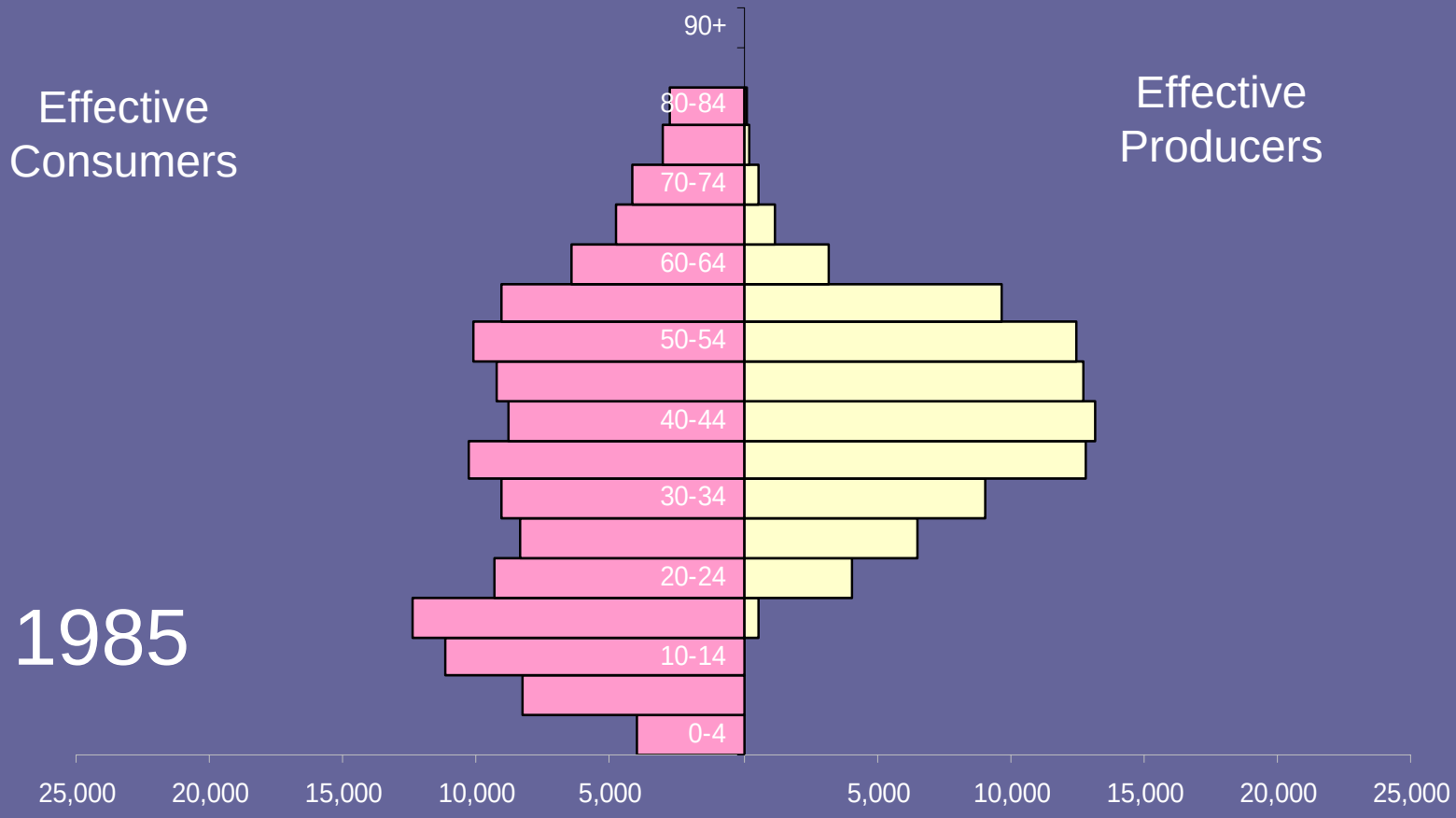

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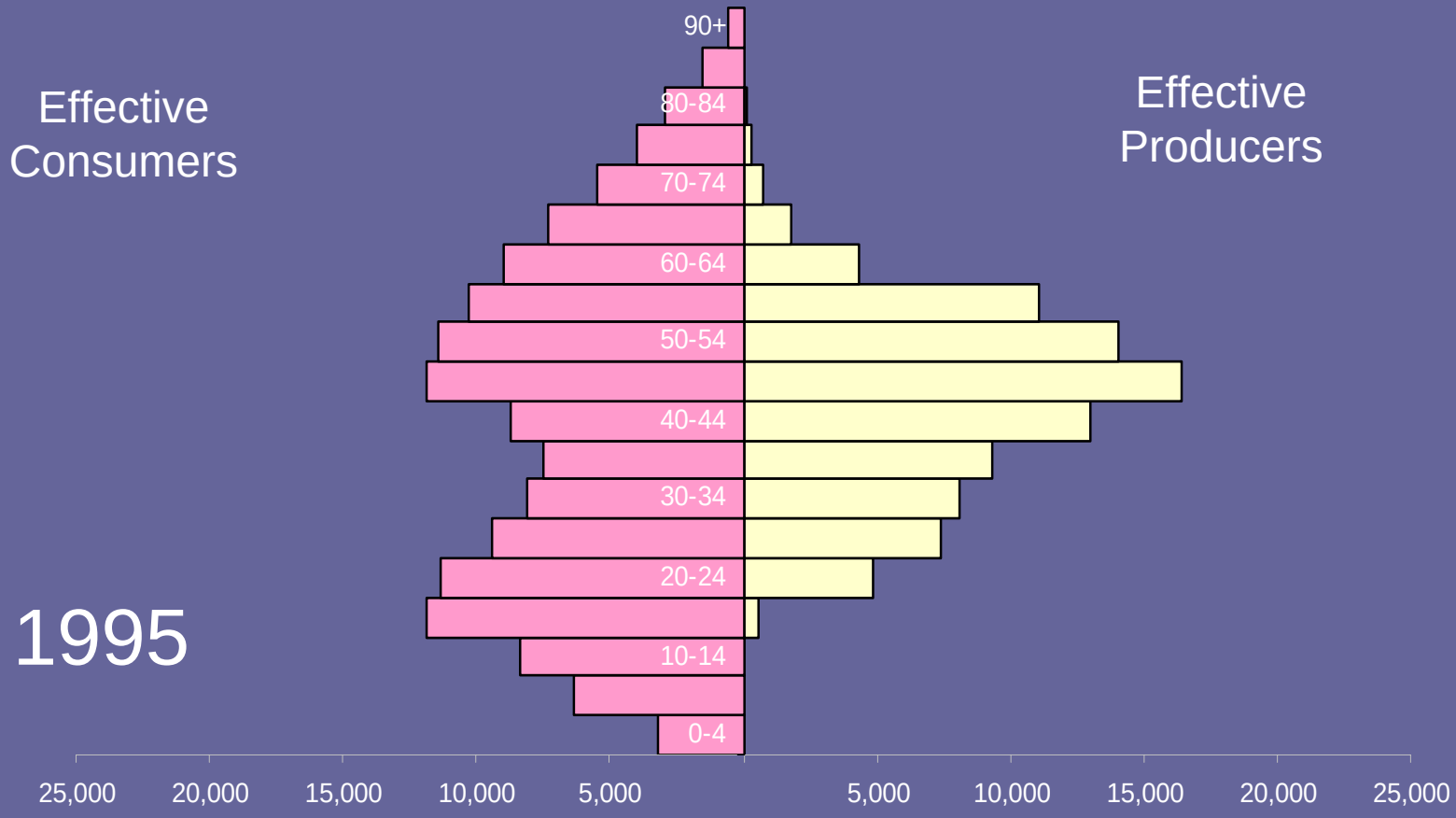

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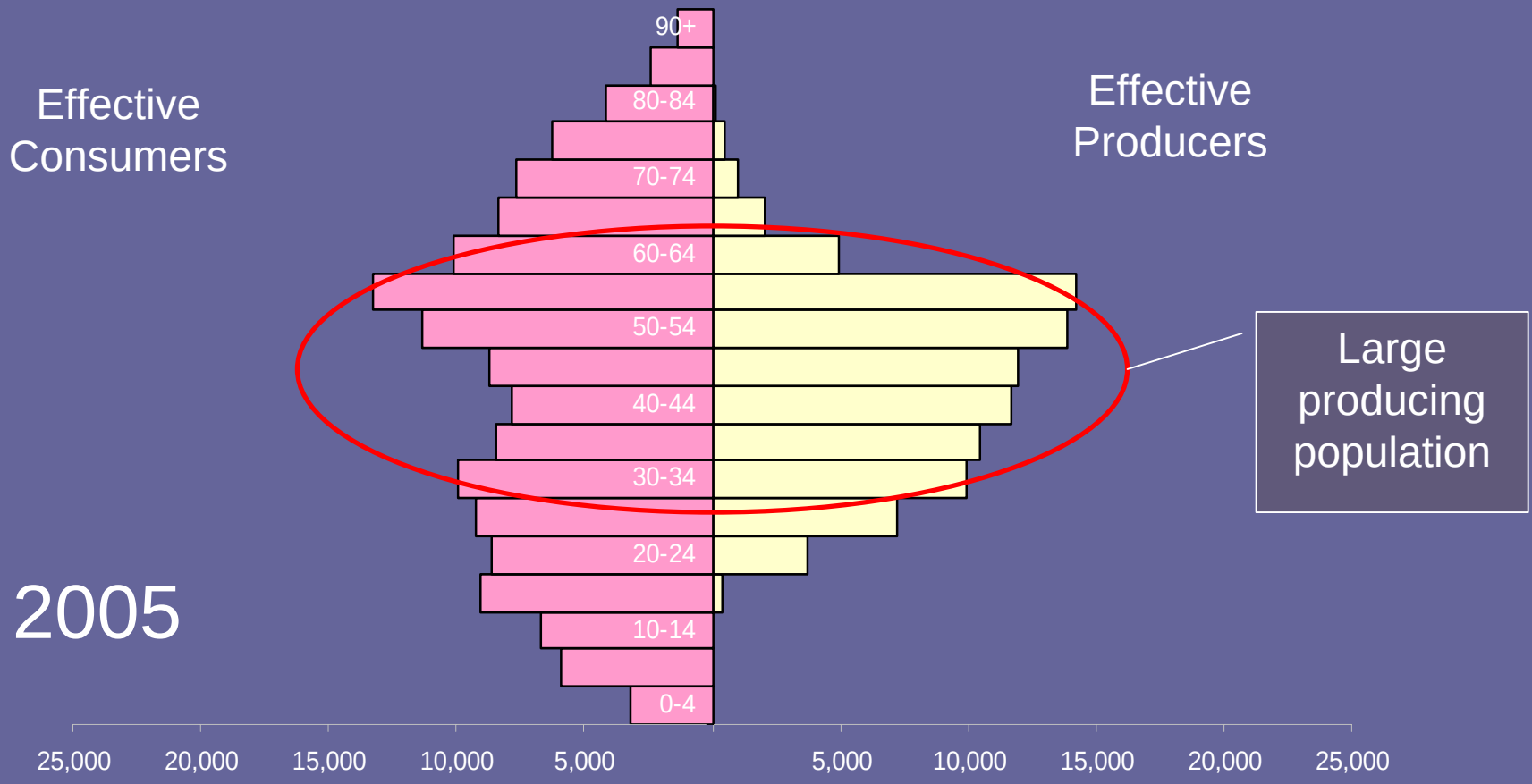
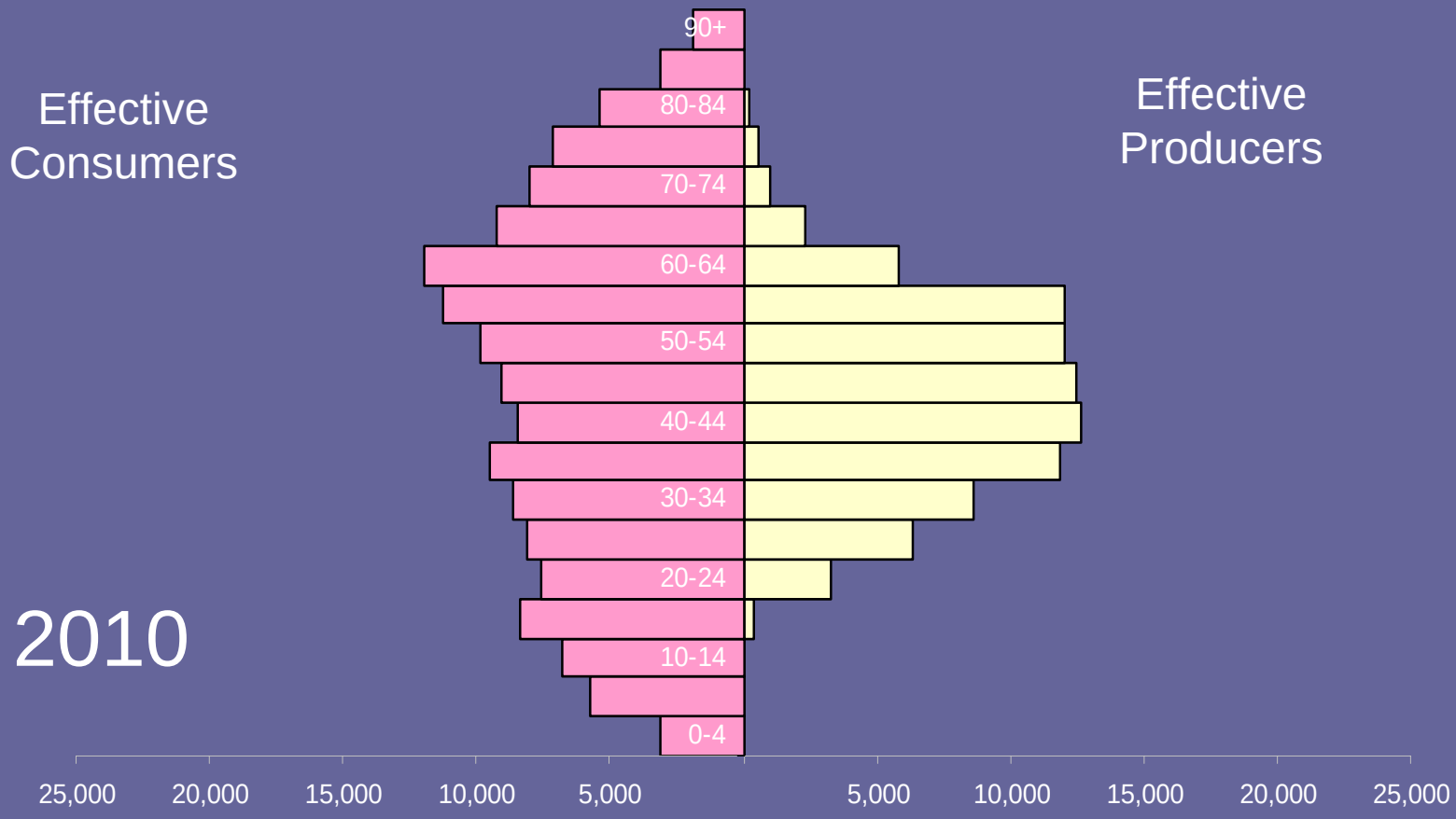
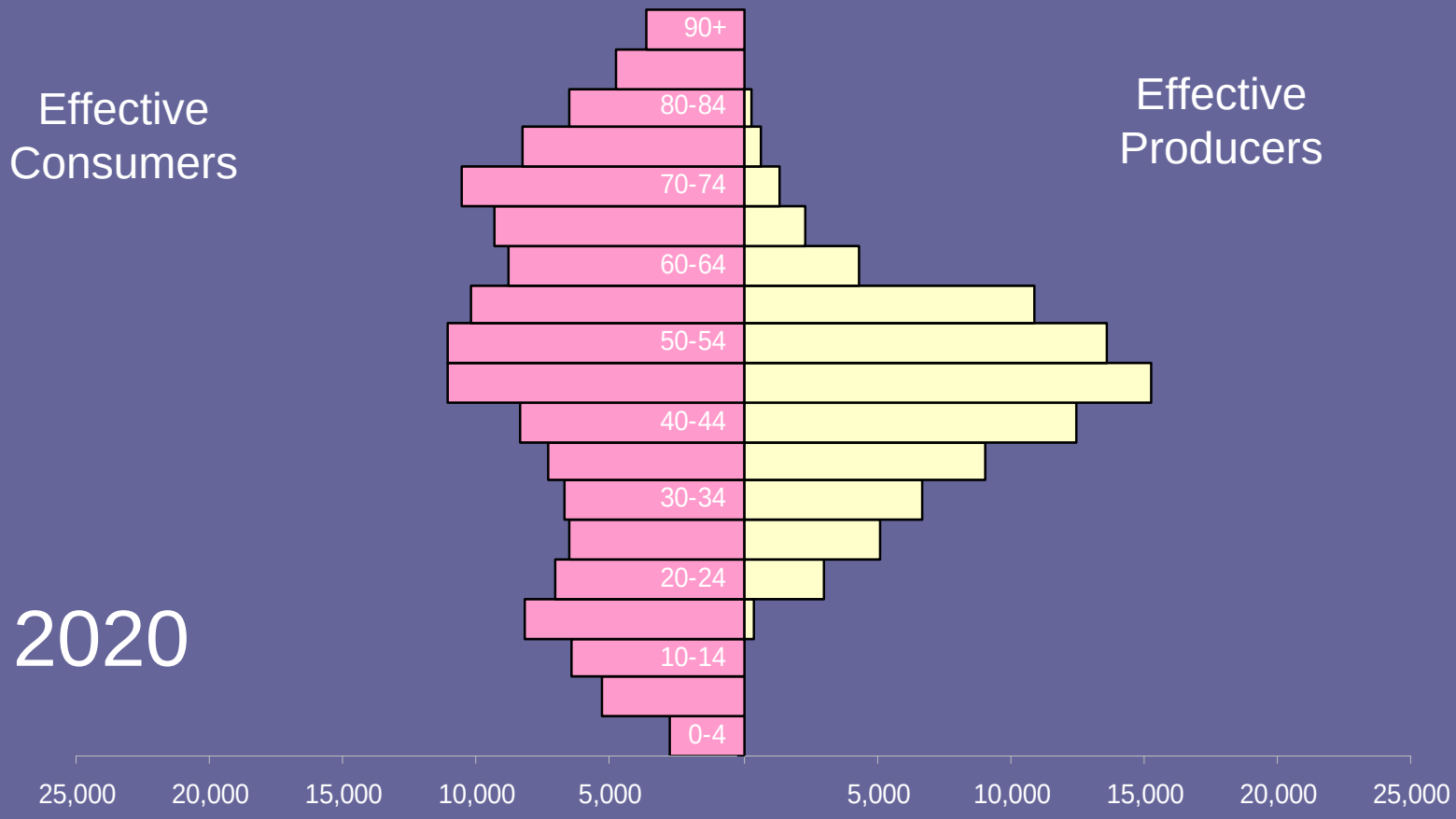


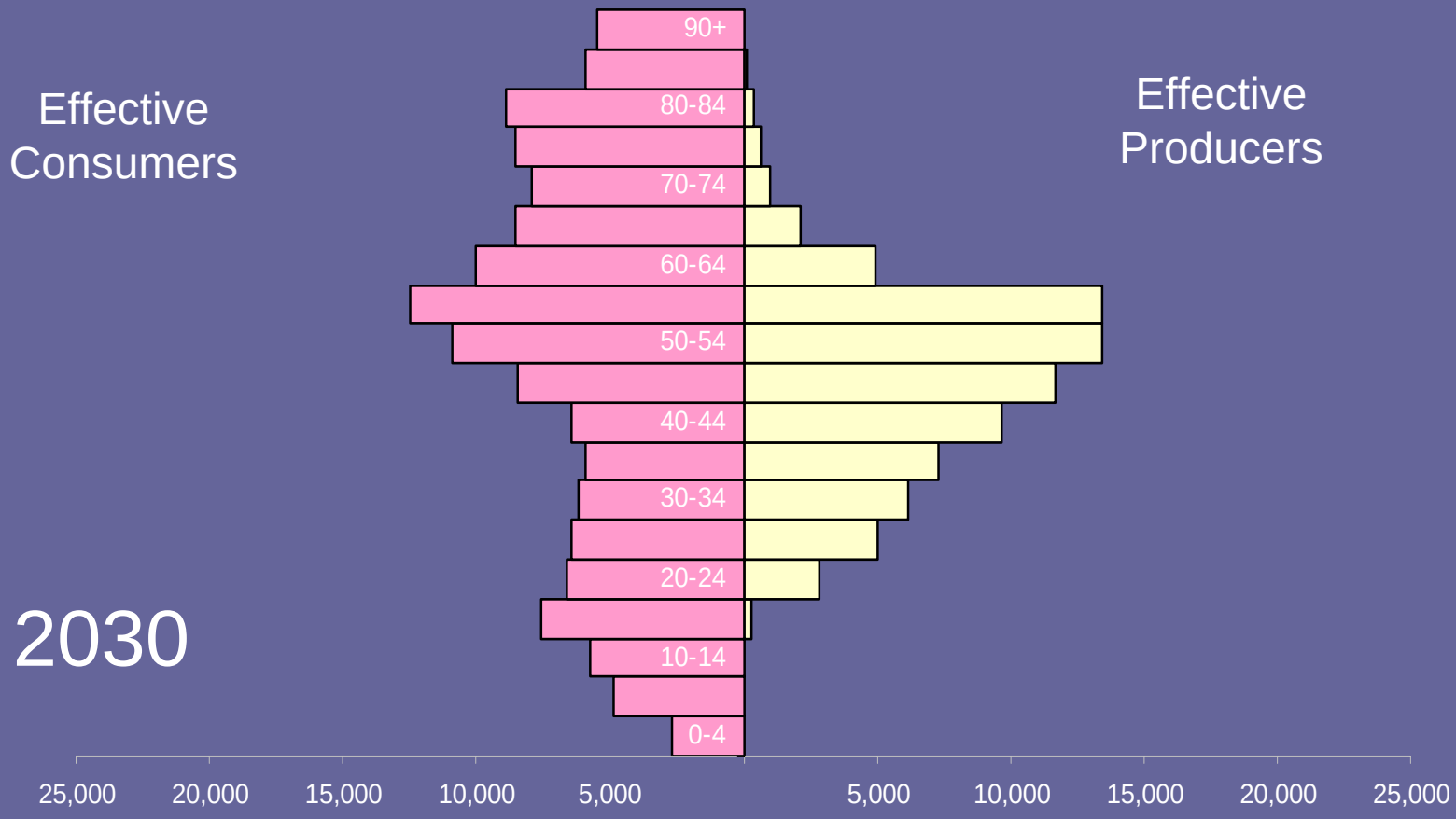
Effective number of consumers and producers by age



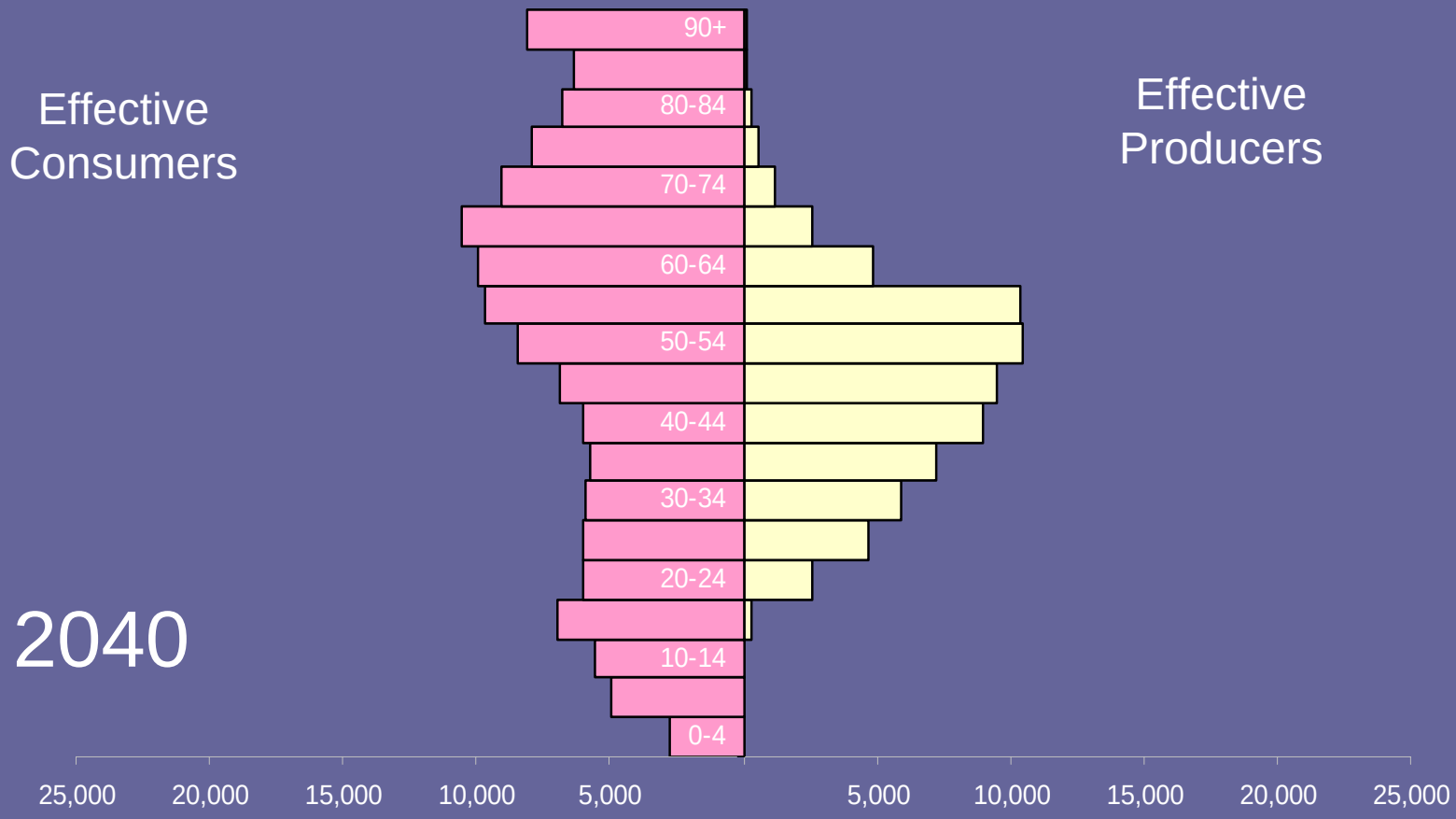
Effective number of consumers and producers by age



Effective number of consumers and producers by age



Effective number of consumers and producers by age



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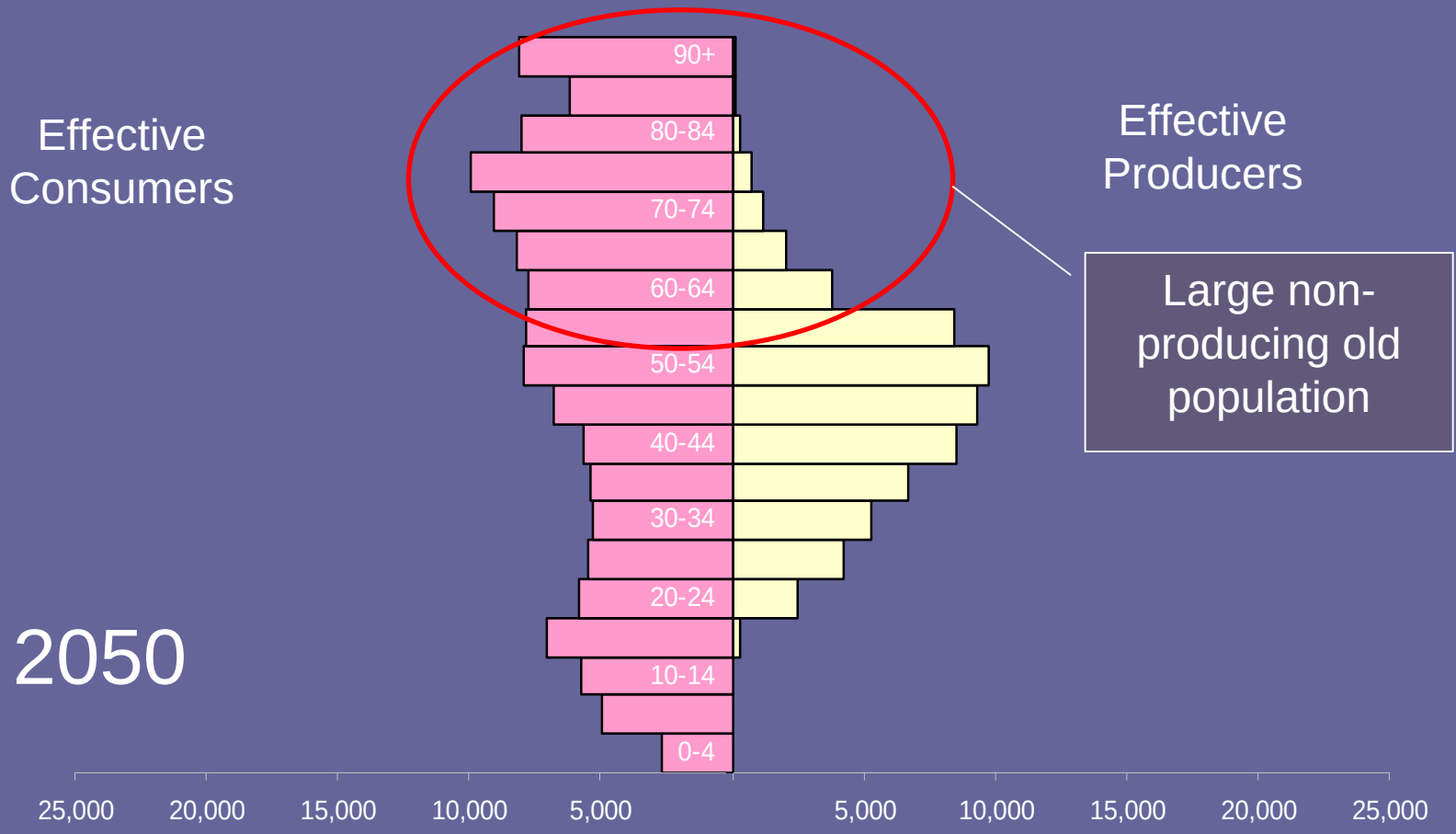
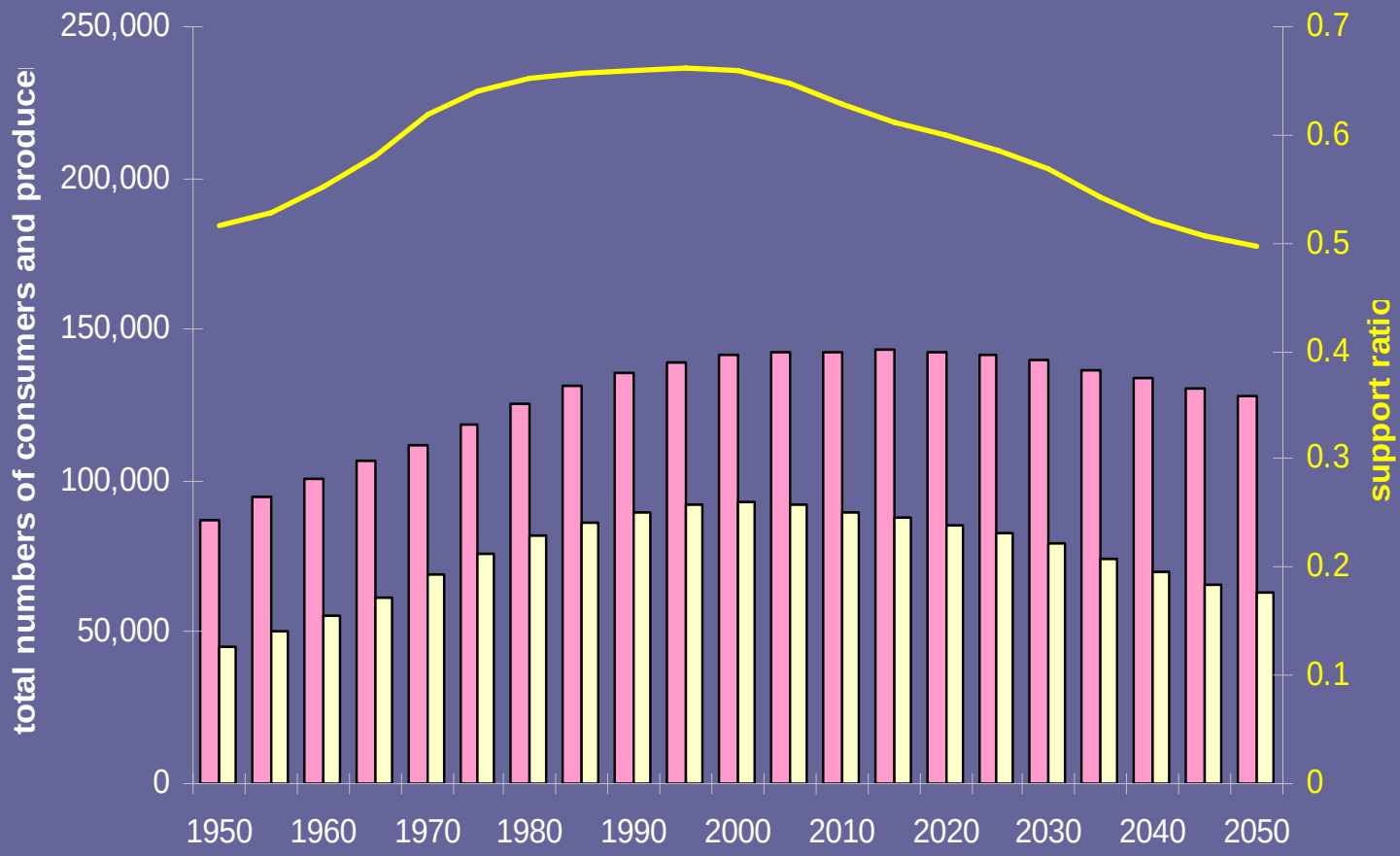


Summarizing the Balance Between Producers and Consumers

The *support ratio* measures the number of producers per consumer.

$$\text{Support ratio} = \frac{\text{Effective number of producers}}{\text{Effective number of consumers}}$$

Total number of producers and consumers and support ratio by year, 1950-2050



II. The First Demographic Dividend

The First Dividend

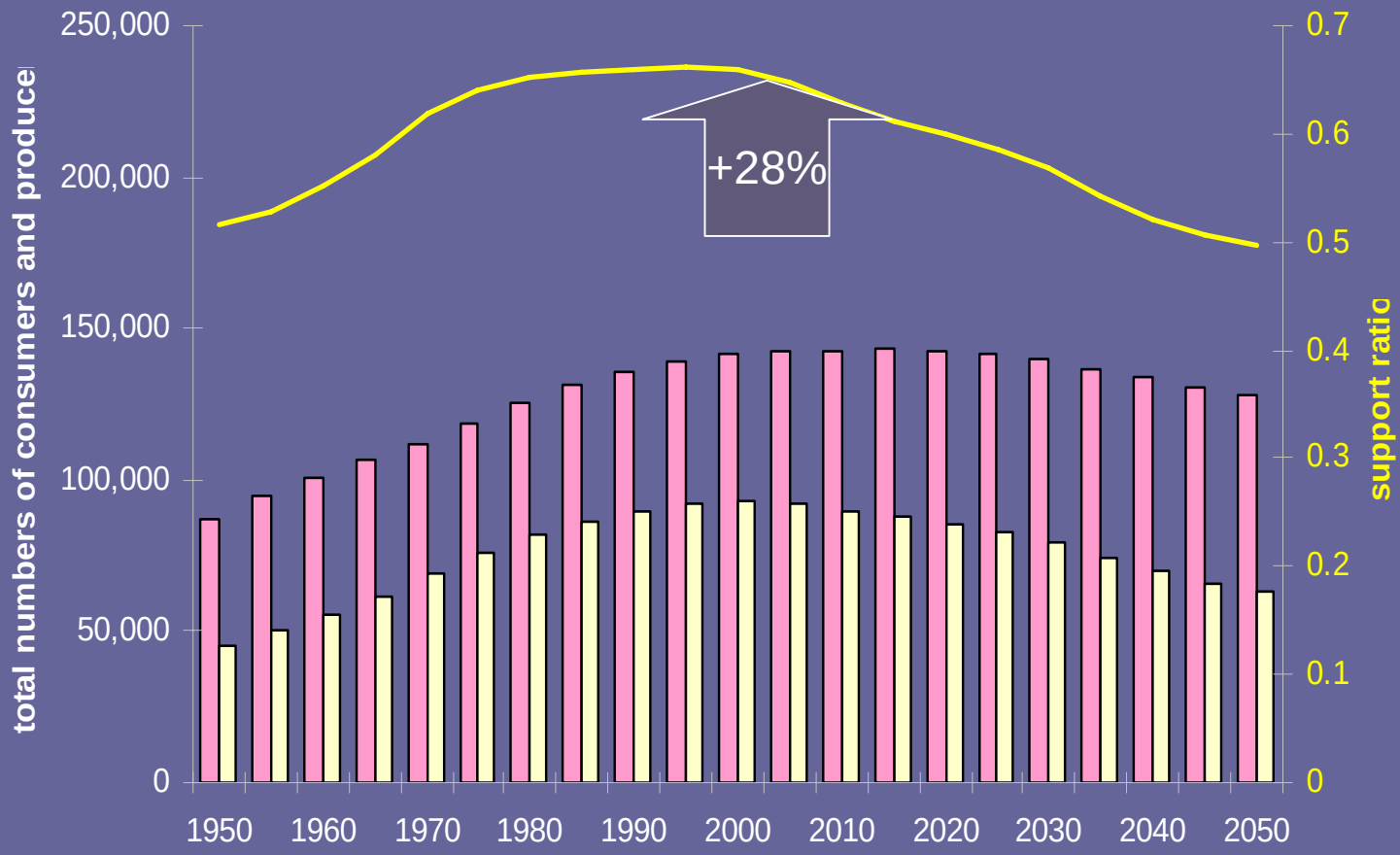
Labor productivity may increase due to techno progress and capital deepening, but is independent of L/N

$$\frac{C(t)}{N(t)} \equiv c(t) \frac{Y^{l}(t)}{L(t)} \frac{L(t)}{N(t)}$$

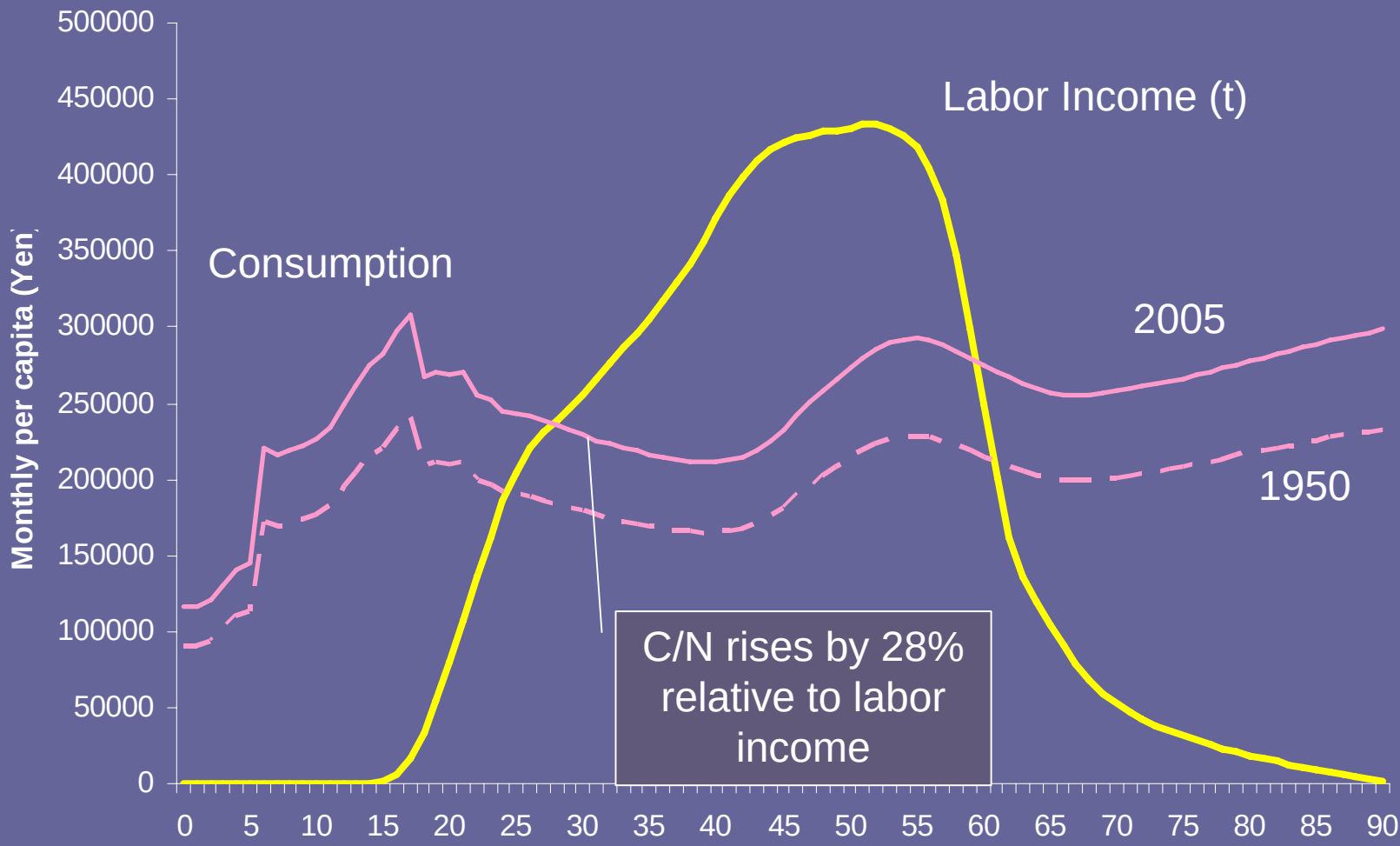
c(t) is held constant (as in Solow model)

An increase in the support ratio (L/N) leads to an equal percentage rise in C/N

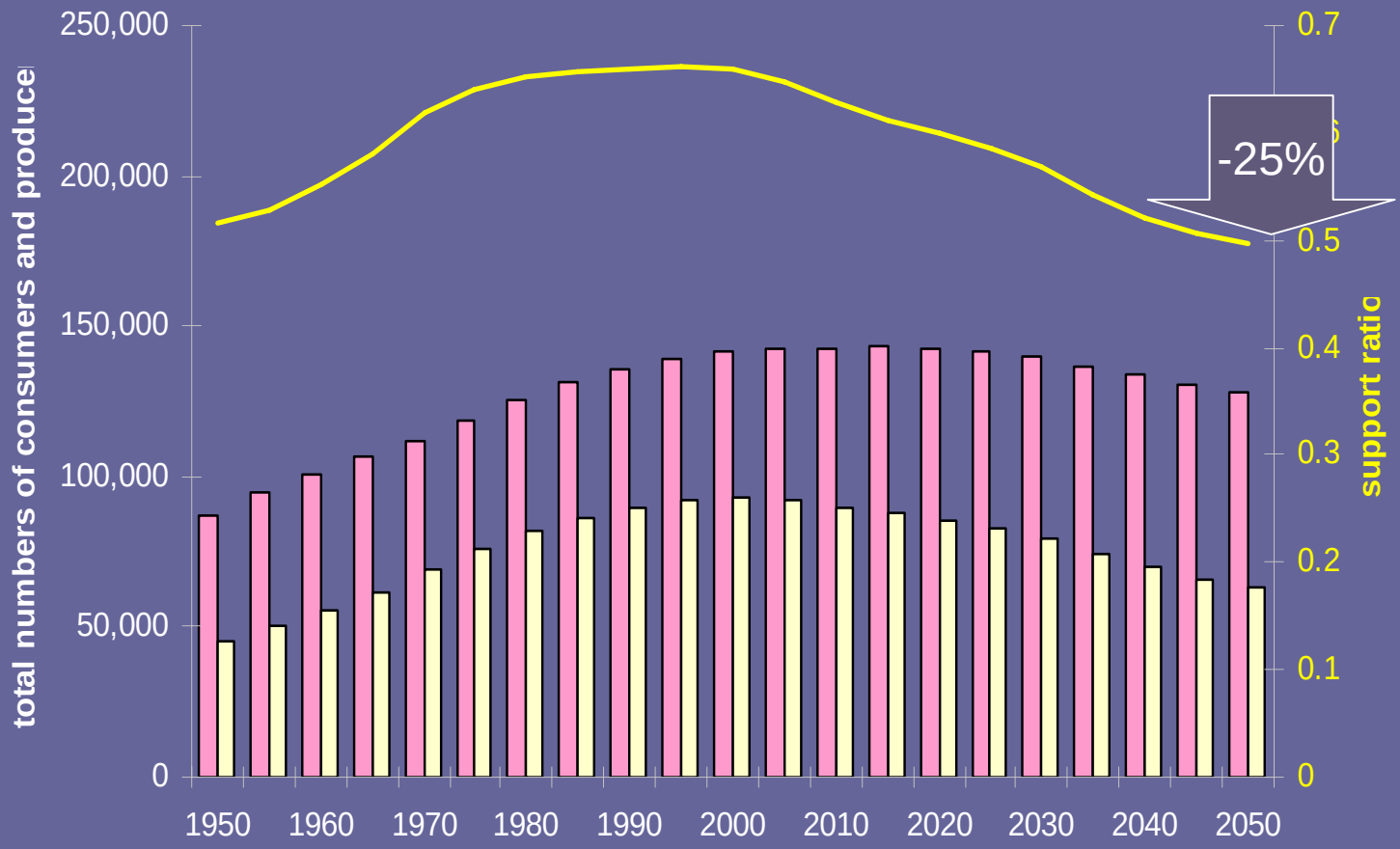
Total number of producers and consumers and support ratio by year, 1950-2050



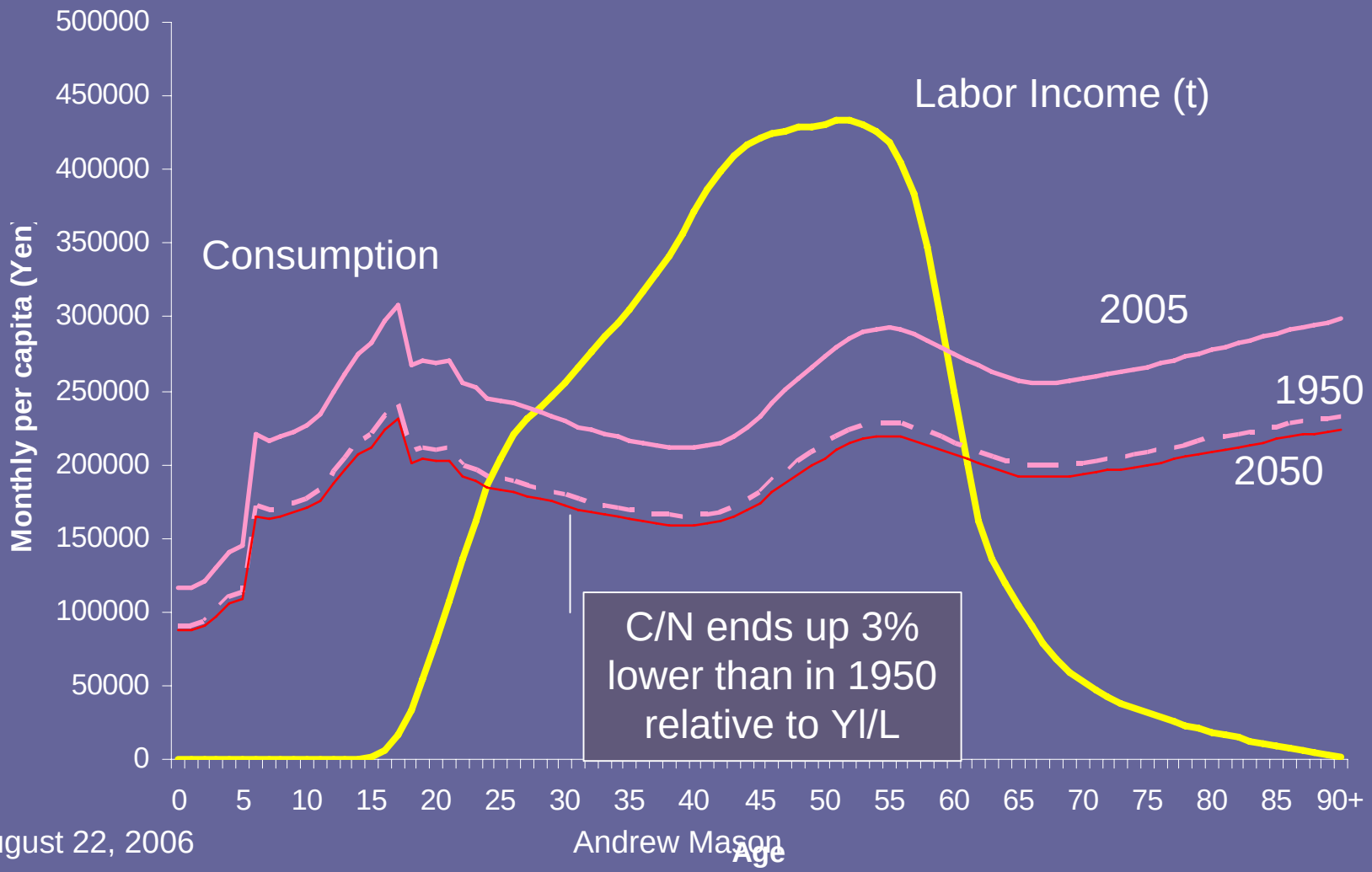
Japan's First Dividend



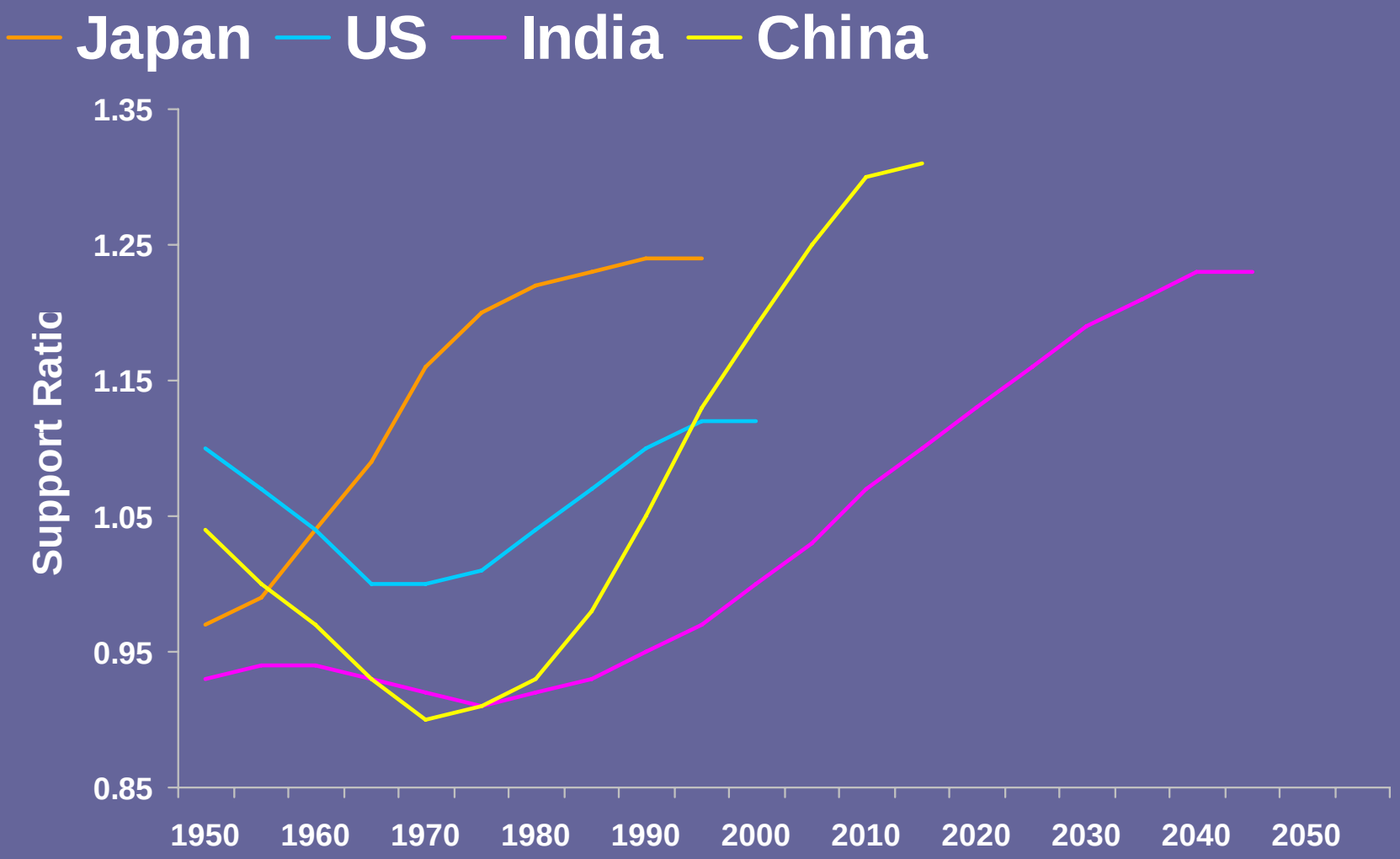
Total number of producers and consumers and support ratio by year, 1950-2050



The End of Japan's Dividend

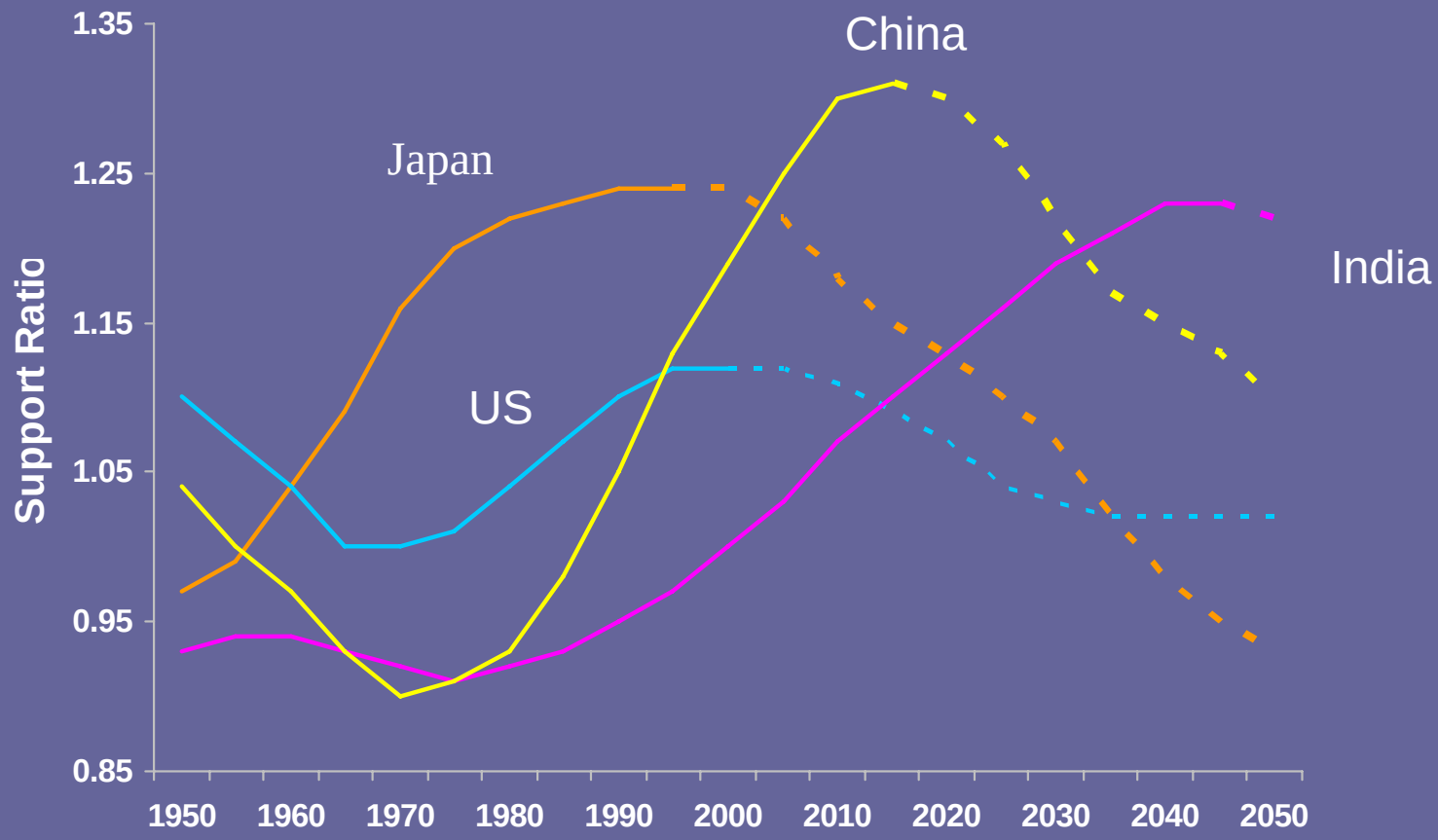


The First Dividend



	First Dividend Period	Annual increase in per capita income	Total increase in per capita income
Japan	1950-1995	0.5%	27.8%
China	1970-2015	0.8%	45.6%
India	1975-2045	0.4%	35.2%
US	1970-2000	0.4%	11.4%

The End of the First Dividend
Japan, US, India, China



Net Effect of the Support Ratio, 1950 - 2050

	Percentage change in support ratio, 1950-2050
Japan	-3.5%
China	5.5%
India	27.4%
US	-8.2%

First Dividend Summary

- Demographic transition leads to favorable change in age structure (increase in support ratio).
- If the saving rate is held constant, consumption increases relative to labor income by the same percentage as the support ratio – the First Dividend.
- The First Dividend is transitory.

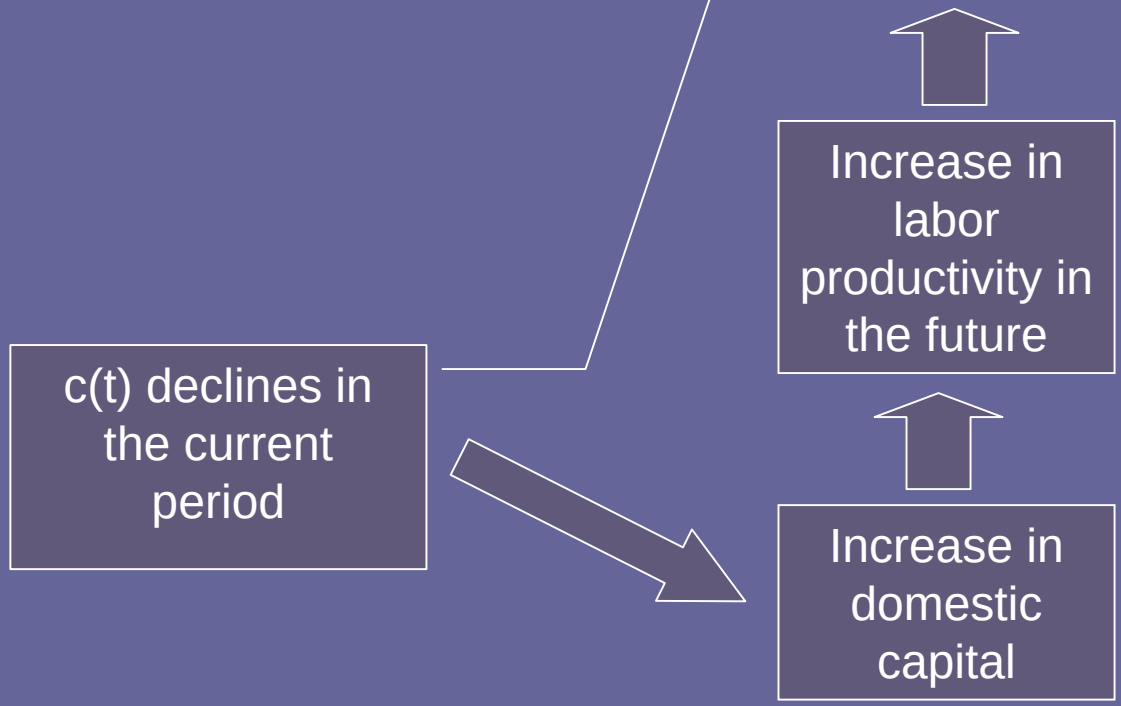
III. The Second Demographic Dividend

The Second Dividend

- First dividend creates a “window of opportunity”.
- Rise in support ratio makes it possible to increase per capita consumption and the saving rate at the same time.
- Population aging leads to an increase in the demand for wealth to meet pension needs.
- If workers save more (increase asset-based reallocations), higher consumption is possible even after the first dividend period has come to an end.

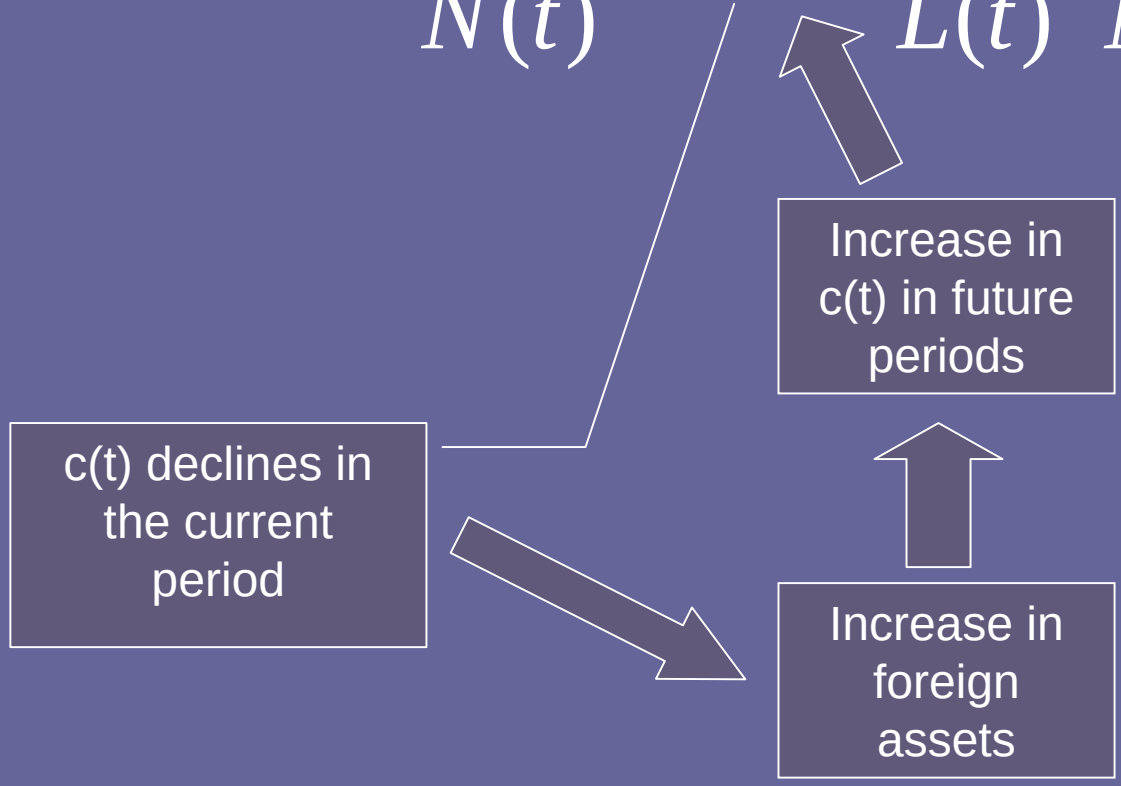
The Second Dividend: Closed Economy

$$\frac{C(t)}{N(t)} \equiv c(t)\frac{Y^{l}(t)}{L(t)}\frac{L(t)}{N(t)}$$



The Second Dividend: Open Economy

$$\frac{C(t)}{N(t)} \equiv c(t)\frac{Y^{l}(t)}{L(t)}\frac{L(t)}{N(t)}$$



Critical Issue: How will population aging influence c(t) and assets?

- Population aging will lead to an increase in the old-age lifecycle deficit.
- Reallocations from the working ages to old ages must increase.
- Either transfers from workers to the elderly must increase; asset-based reallocations must increase; or both.
- To the extent that asset-based reallocations increase (higher saving), the Second Dividend is realized.

Model of Consumption/Saving

- Cross-sectional profile of labor income is fixed
  - No changes in labor force participation
  - Age profile of productivity is fixed
- Cross-sectional profile of consumption is fixed
  - Generational differences in consumption reflect unchanging altruism
  - Different from the lifecycle hypothesis

Lifecycle wealth (W)

W = PV[C]-PV[Yl]

- PV[C] is the present value of current and future consumption for those who are currently adults.
- PV[Yl] is the present value of current and future labor income for those who are currently adults.

Two Components of W

$$W = Tk + Wp$$

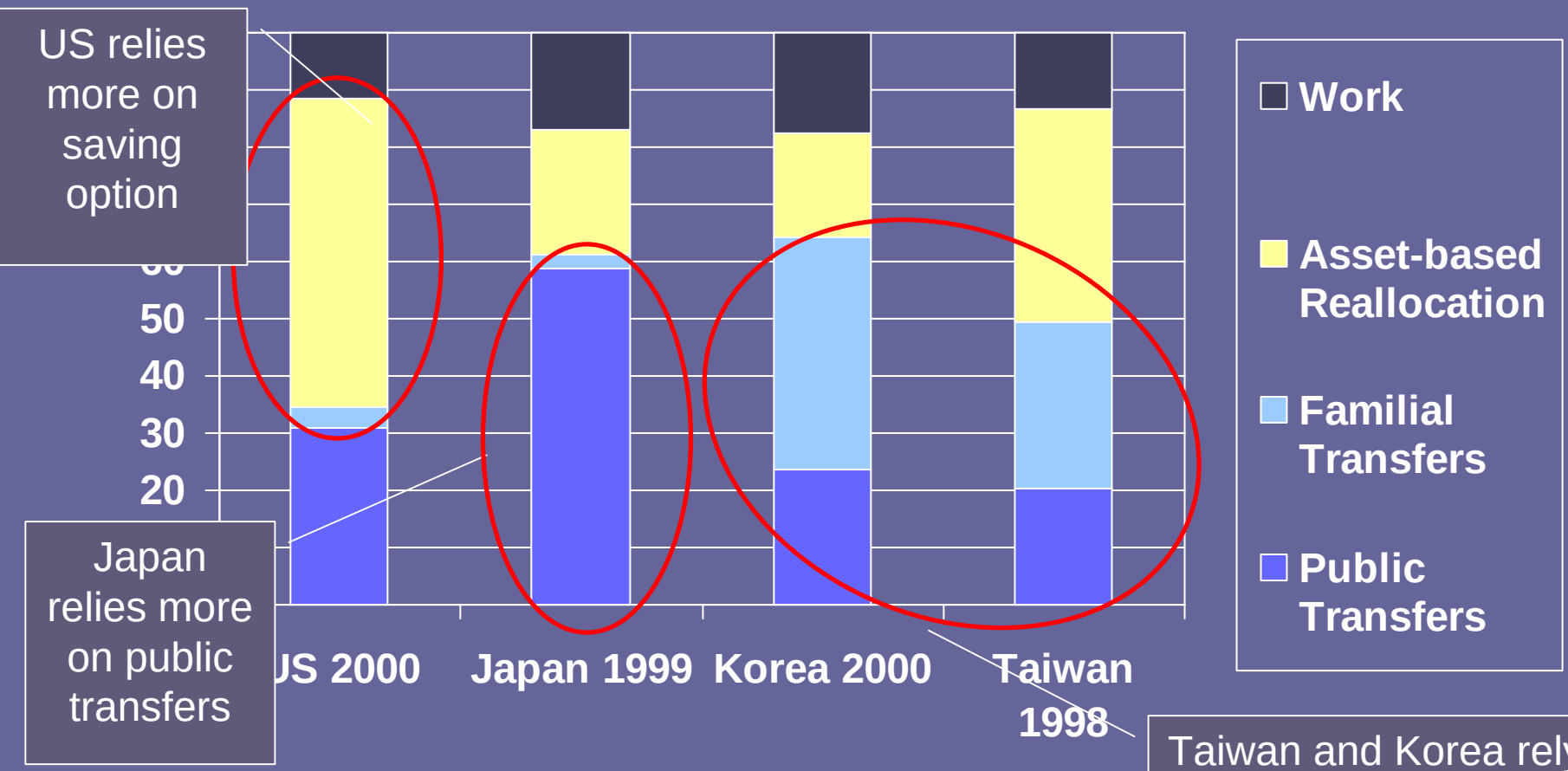
- Child transfer wealth (Tk)
  - The present value of future transfers to children
  - Tk is a liability and negative
- Pension wealth (Wp)
  - The present value of consumption in excess of labor income (the old age lifecycle deficit) in future periods

Components of Pension Wealth

- Transfer wealth
- Assets (A(t))
- Key assumption: assets is a constant fraction of pension wealth.

$$A(t) = (1-\tau)W_p(t)$$

Financing Old-age Consumption Taiwan, Korea, US



Source: Mason et al. 2006

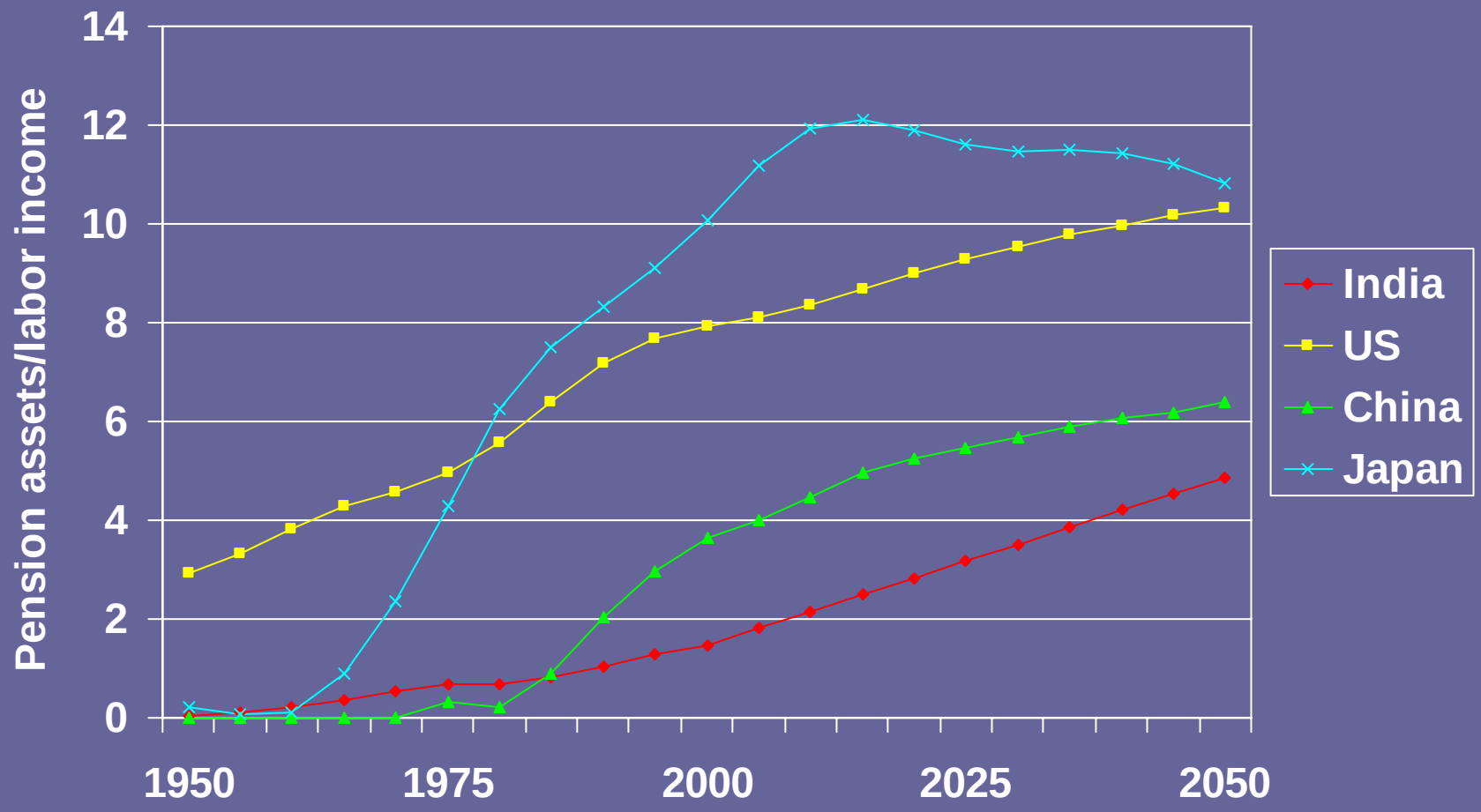
Will aging lead to greater wealth?

- Fewer children leads to less spending on children.
- Older adults are wealthier than young adults.
- Increase in life expectancy leads to longer retirement and greater demand for wealth.
- Increased reliance on transfer option undermines these effects.

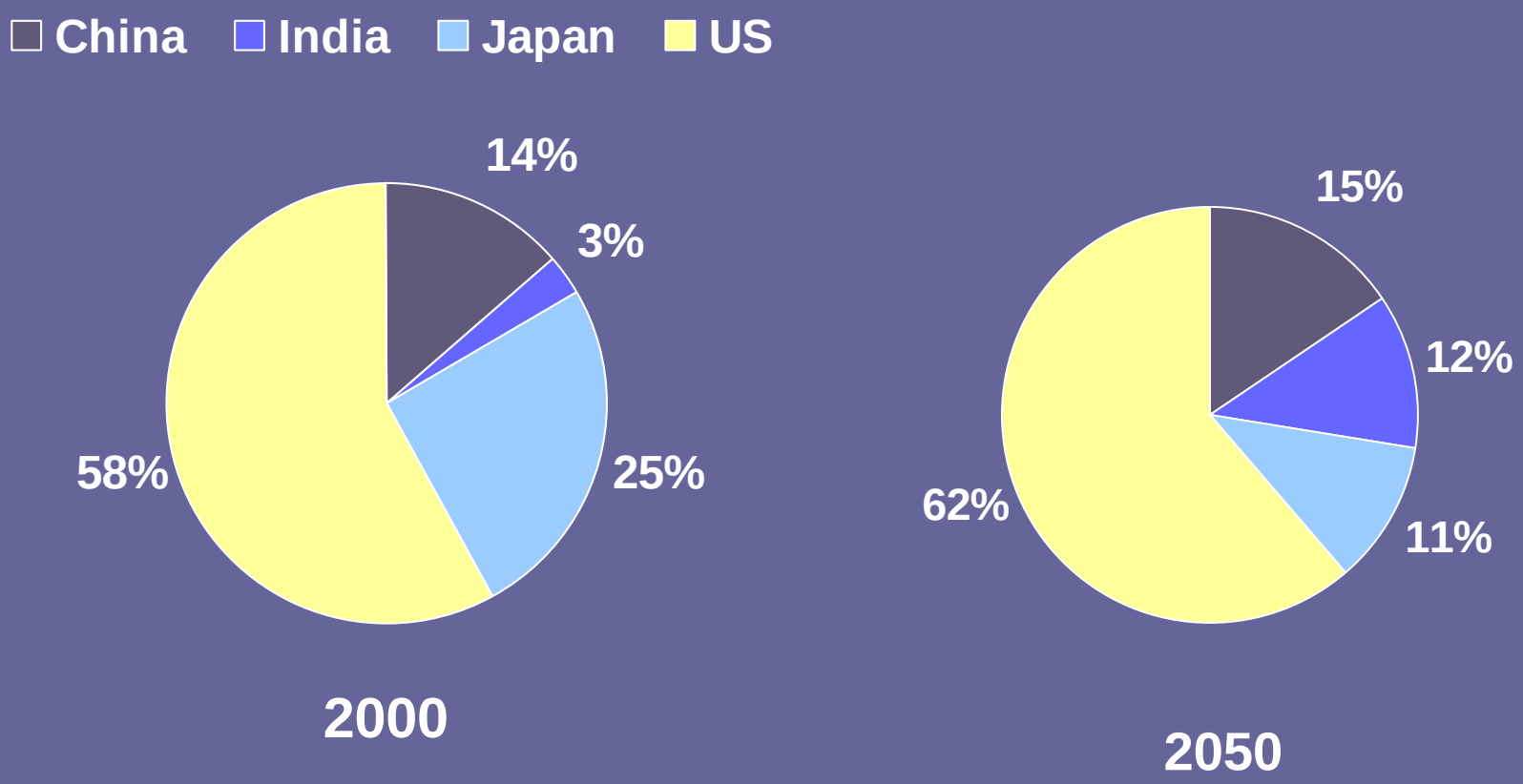
Simulations I

- Detailed methodology described in Mason et al. 2006.
- Current consumption and production profiles persist into the future. Japanese profiles used except for US.
- Asset-based reallocations provide 65% of old-age support; transfers provide 35% of old-age support.

Simulation of Pension Assets Relative to Labor Income



Total Pension Wealth, National Shares, Simulated Values

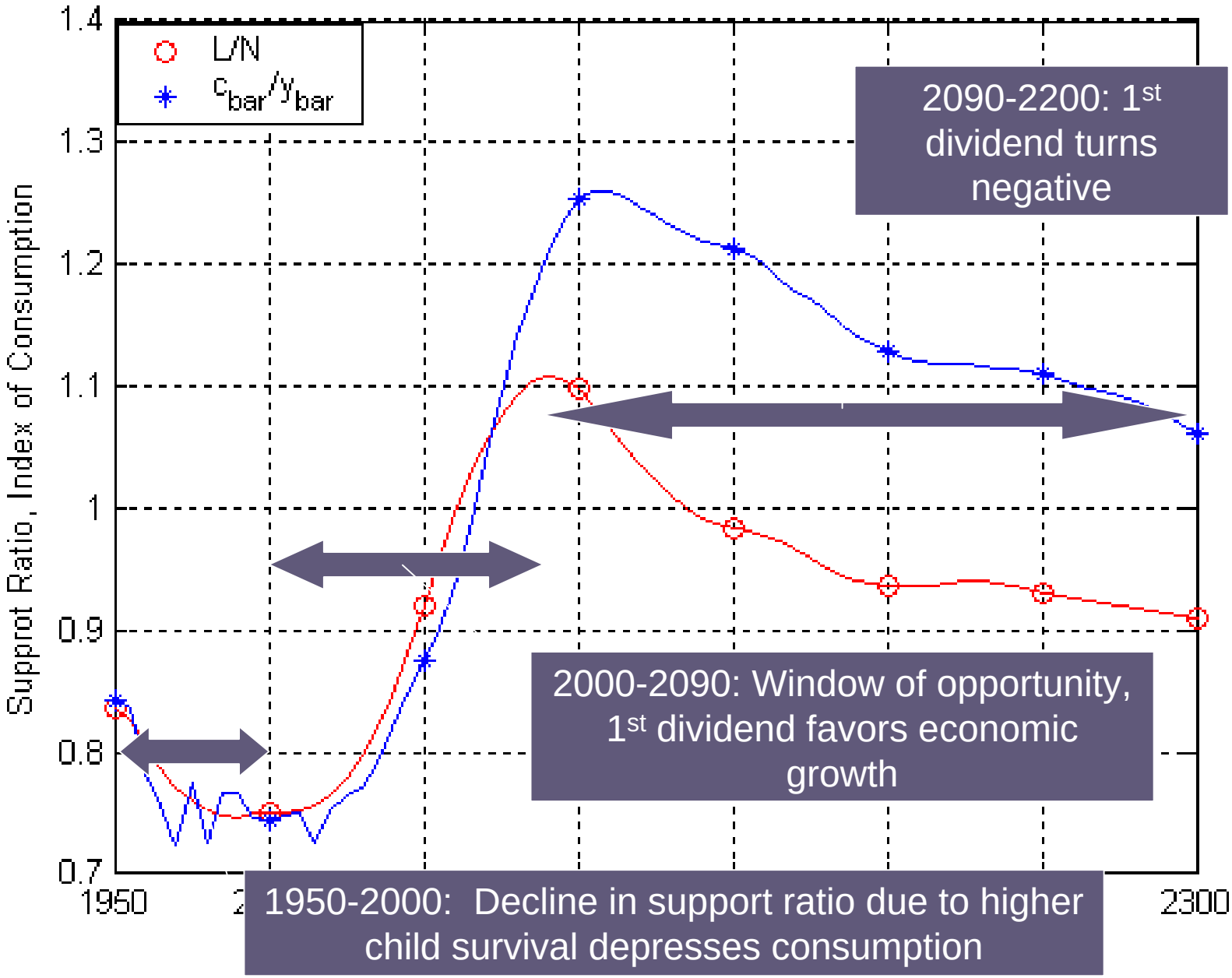


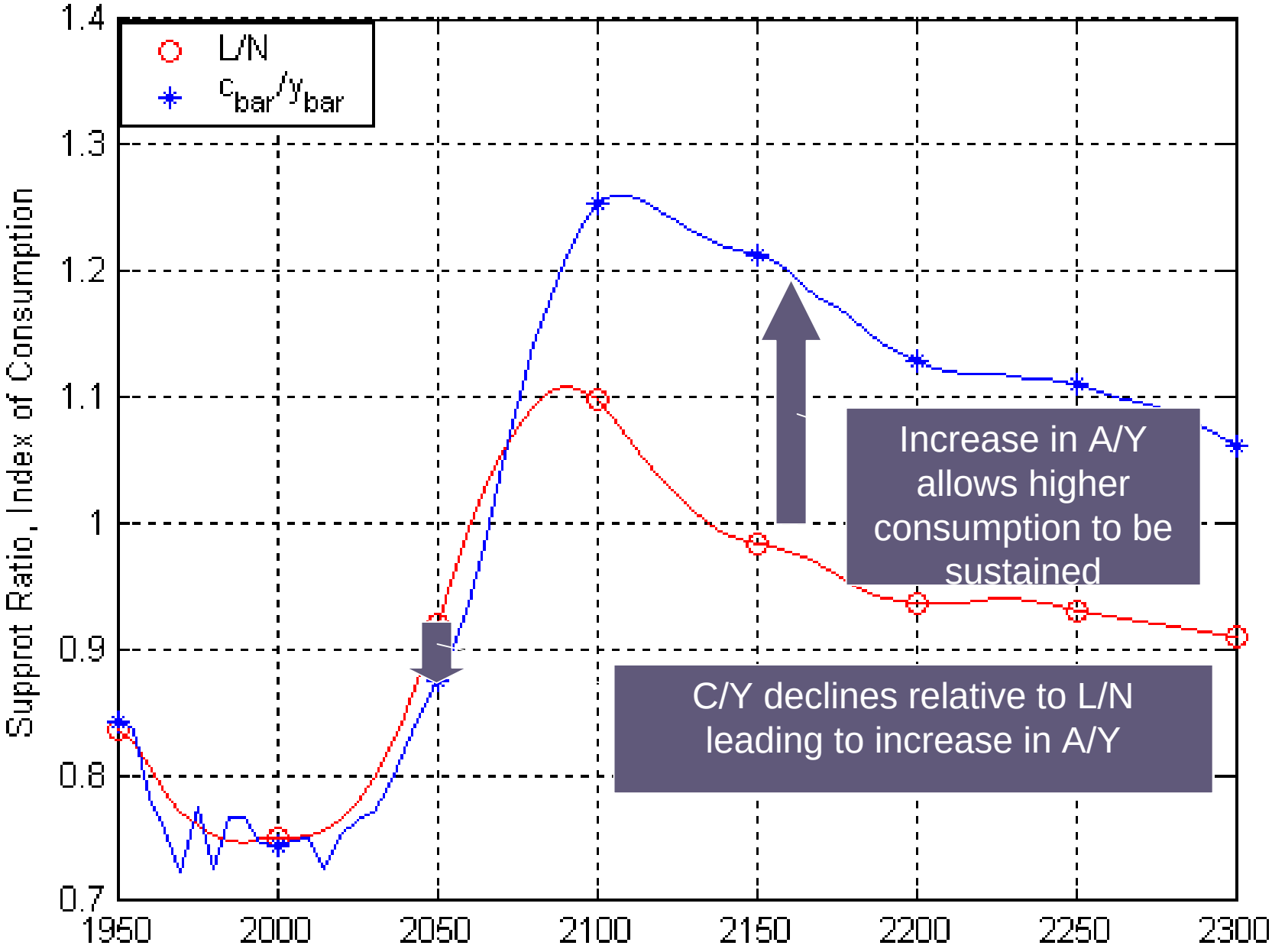
Simulation II

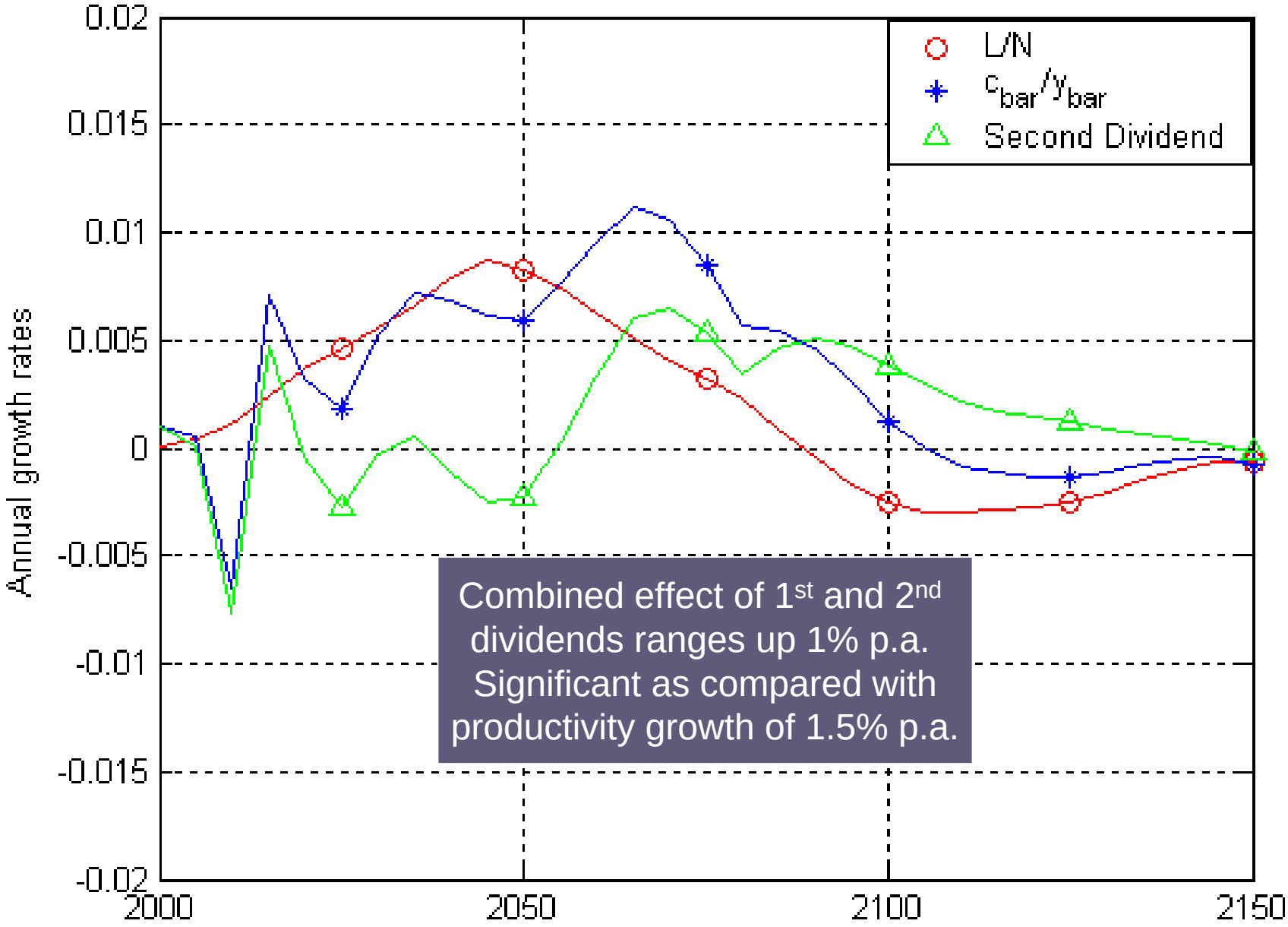
- Niger – highest fertility in the world
- Small open economy
- Details: Mason and Lee 2006 (NTA WP06-01)

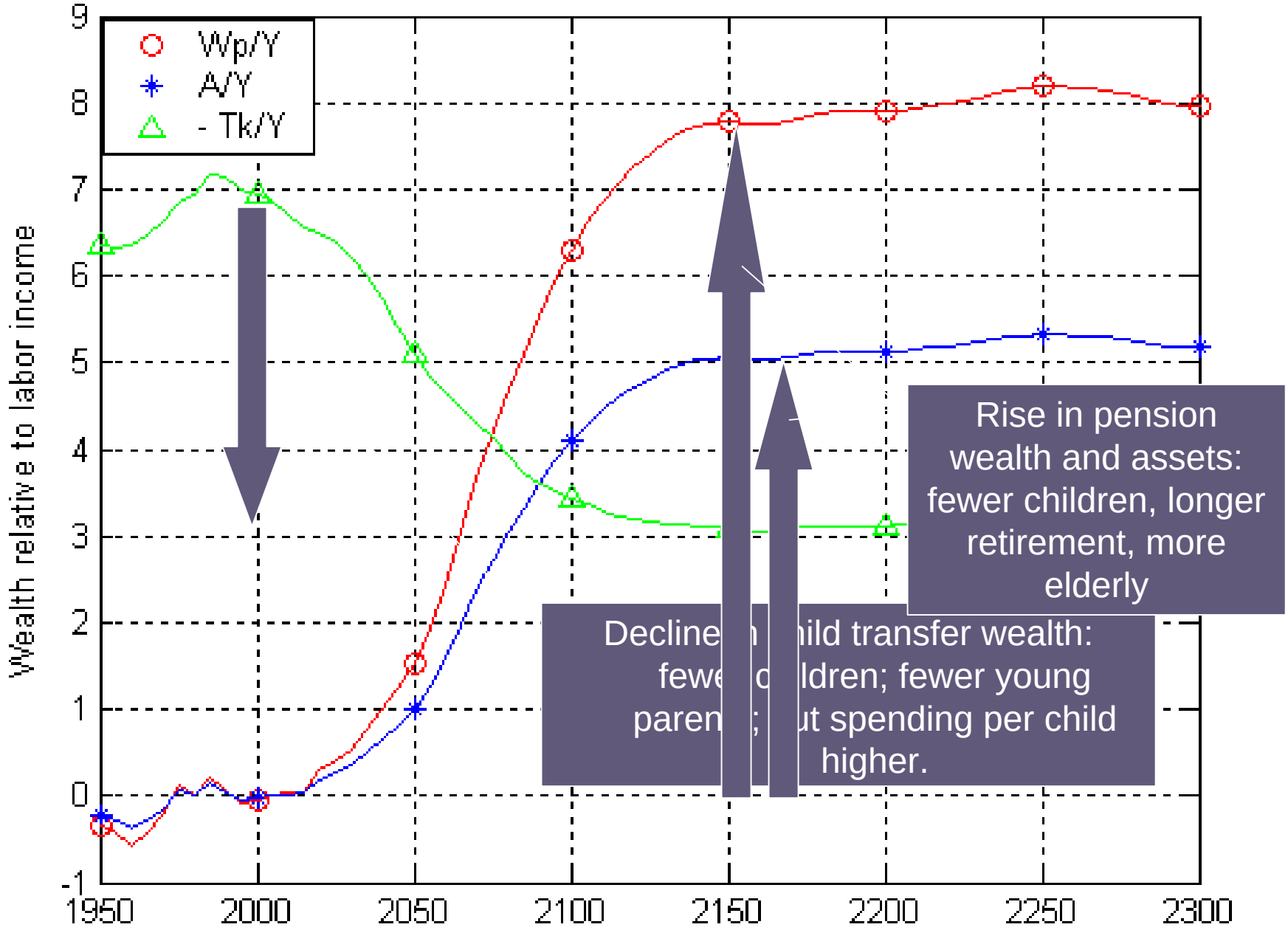
Simulation II Assumptions

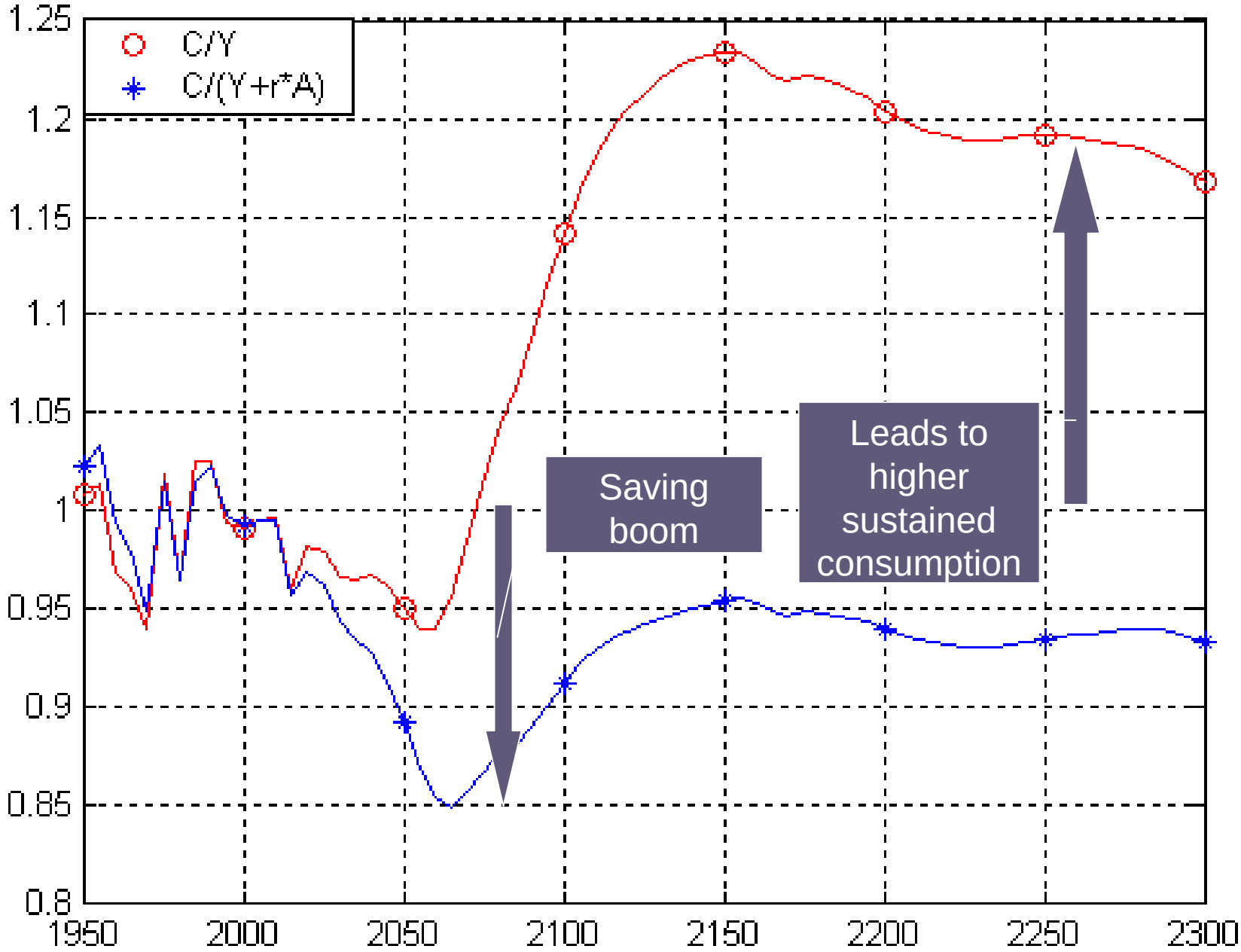
Productivity growth	1.5%
Depreciation rate	3.0%
Discount rate	3.0%
Interest rate	6.0% → 4.2%
Age profiles	Taiwan 1977
Familial share of transfers to children	0.67
Pension transfers as a share of pension wealth	0.35


L/N
c_{bar}/y_{bar}
Supprot Ratio, Index of Consumption
1.4
1.3
1.2
1.1
1
0.9
0.8
0.7
1950
2300
2090-2200: 1st dividend turns negative
2000-2090: Window of opportunity, 1st dividend favors economic growth
1950-2000: Decline in support ratio due to higher child survival depresses consumption


L/N
c_{bar}/y_{bar}
Supprot Ratio, Index of Consumption
1.4
1.3
1.2
1.1
1
0.9
0.8
0.7
1950
2000
2050
2100
2150
2200
2250
2300
Increase in A/Y allows higher consumption to be sustained
C/Y declines relative to L/N leading to increase in A/Y


0.02
0.015
0.01
0.005
0
-0.005
-0.01
-0.015
-0.02
Annual growth rates
2000
2050
2100
2150
L/N
c_{bar}/y_{bar}
Second Dividend
Combined effect of 1st and 2nd dividends ranges up 1% p.a. Significant as compared with productivity growth of 1.5% p.a.


Wp/Y
A/Y
- Tk/Y
Wealth relative to labor income
9
8
7
6
5
4
3
2
1
0
-1
1950
2000
2050
2100
2150
2200
2250
2300
Rise in pension wealth and assets: fewer children, longer retirement, more elderly
Decline in child transfer wealth: fewer children; fewer young parents; but spending per child higher.


C/Y
C/(Y+r*A)
1.25
1.2
1.15
1.1
1.05
1
0.95
0.9
0.85
0.8
1950
2000
2050
2100
2150
2200
2250
2300
Saving boom
Leads to higher sustained consumption

The Demographic Dividends

- First Dividend
  - Leads to 50% increase in consumption per equivalent adult
  - Dividend period (window of opportunity) lasts for 70 years
  - First dividend is ultimately transitory – by 2200 support ratio is only 10% above its 1950 level

The Demographic Dividends

- The Second Dividend
  - First dividend is being capitalized: consumption depressed by about 5% until near the end of the first dividend period
  - Adds almost 20% to consumption at the peak and thereafter
- Combined effect of the two dividends: explains 25% of growth from 2030-2090.

Limitations

- Closed economy model not complete
- World-wide effects of population aging not considered
- Assumption about asset-based reallocations (constant tau) too simple.

Conclusions

- Age structure has important macroeconomic effects on income, consumption, assets, and other important variables.
- An important and permanent second dividend is available.
- Critical that countries emphasize saving option over transfer option during the “window of opportunity”.
- Substantial regional shifts in GDP and assets are likely.

Relationship to earlier work

- Lee, Miller, and Mason (SJE and other)
  - Standard lifecycle saving model
  - Transfer system was directly modeled
    - Reformed US public transfer system to make it sustainable
    - Phased out familial transfers in Taiwan
- Mason (Mexico City paper)
  - Constant tau and altruism as here
  - Assumed surplus before age 50 went to children and after age 50 to retirement; no need to calculate child costs

Model and NTA

- NTA estimates provide model parameters
  - Labor income and consumption
  - Public and private transfers to children
  - Public transfers to the elderly
- Projections of macro variables for NTA
  - Labor Income
  - Consumption
  - Non-labor income
  - Familial transfers
  - Public transfers

Notes, Sources, and Funding

- Production and consumption profiles
  - Japan: Nihon University Population Research Institute under direction of Naohiro Ogawa.
  - Taiwan: East-West Center (Honolulu) and Academia Sinica (Taipei) under direction of Andrew Mason and An-Chi Tung.
  - United States: Center for the Economics and Demography of Aging, University of California at Berkeley under direction of Ronald Lee.
- Methodology
  - Mason and Lee 2006.
  - Mason, Lee, Tung, Lai, and Miller 2005.
  - Lee, Lee, and Mason 2006.
  - www.ntaccounts.org
- Funding
  - National Institute on Aging (US): R01 AG025488 and R37 AG025247

The End