

Market Human Capital

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Human Capital - What Matters?

- In analysis by gender HC paper
- Fraumeni & Christian (2018, forthcoming), which covers 1975-2012
 - Labor force participation
 - Enrollment, particularly at tertiary level
 - Gender gap
 - Time use
- What trends are likely to occur in the future? and the pipeline

Human Capital Ranking

(of 15 for PISA, of 13 for PIAAC, and of 18 otherwise)

	PISA Science 2006	PIAAC Literacy 2011-2*	PIAAC Numeracy 2011-2*	PIAAC Problem-solving in Tech-rich Environments, 2011-2*
Ages	15	15	15	15
Great Britain	5	7	8	6
USA	8	9	11	8
	Barro-Lee Avg. Ed. Attainment 2005	Inclusive Wealth Report per Capita 2014 preliminary, 2005**	Jorgenson-Fraumeni Human Capital per Capita, 2006	World Bank Intangible Capital, 2005
Ages	15-64	All ages	15-64	All ages
Great Britain	16	4	2	3
USA	1	1	1	1

Source: UNECE (2016) Guide to Measuring Human Capital

* England & N. Ireland, **Representative worker human capital is allocated to all adults in the country, lifetime incomes are PPP adjusted.

Pipeline?

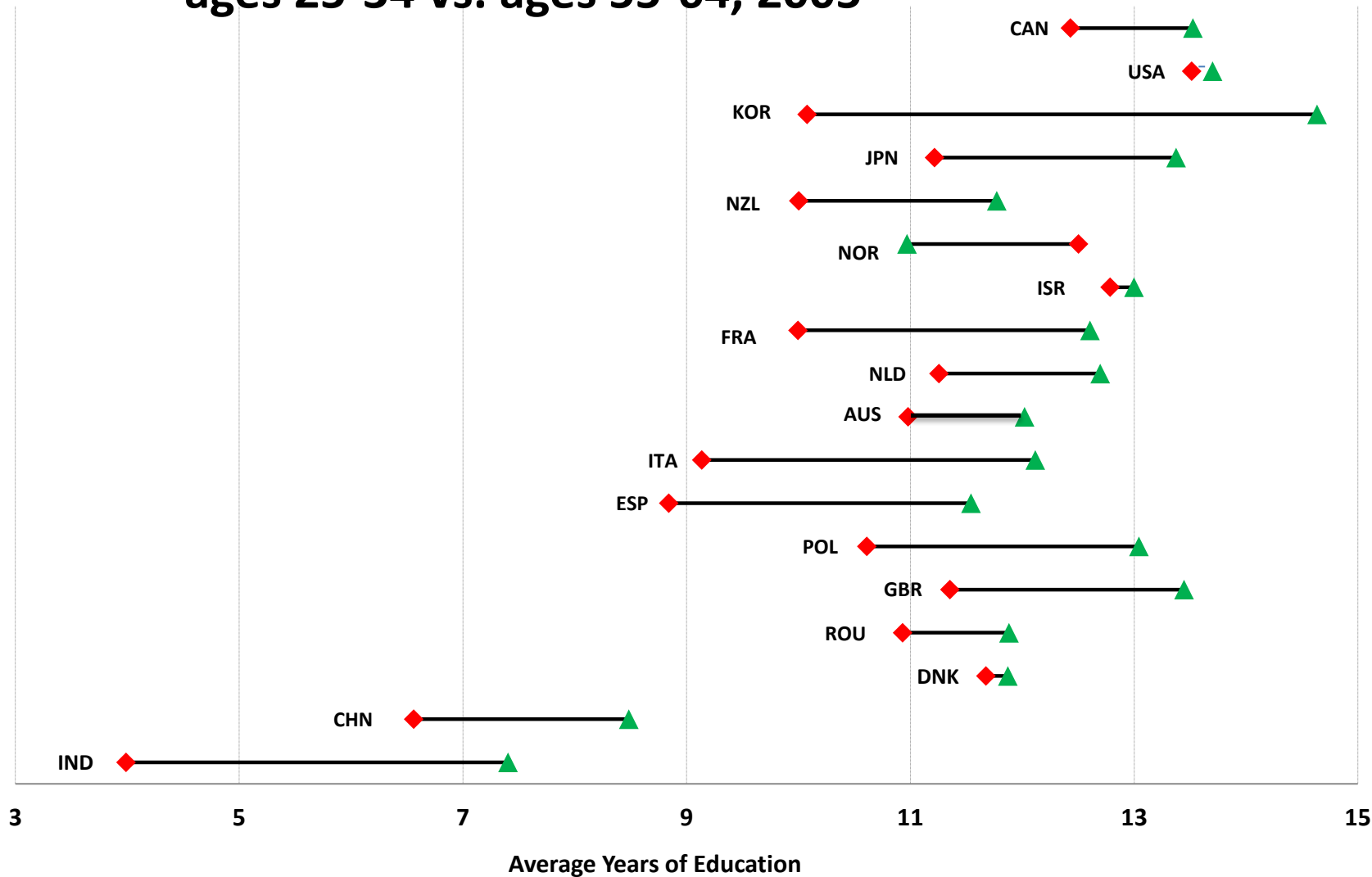
- **Younger individuals, those aged 25-34, vs. older individuals, those aged 55-64**
- **Barro-Lee Years of School Data**

The Young Are the Future



Education Attainment Comparisons

ages 25-34 vs. ages 55-64, 2005



25-34 years old

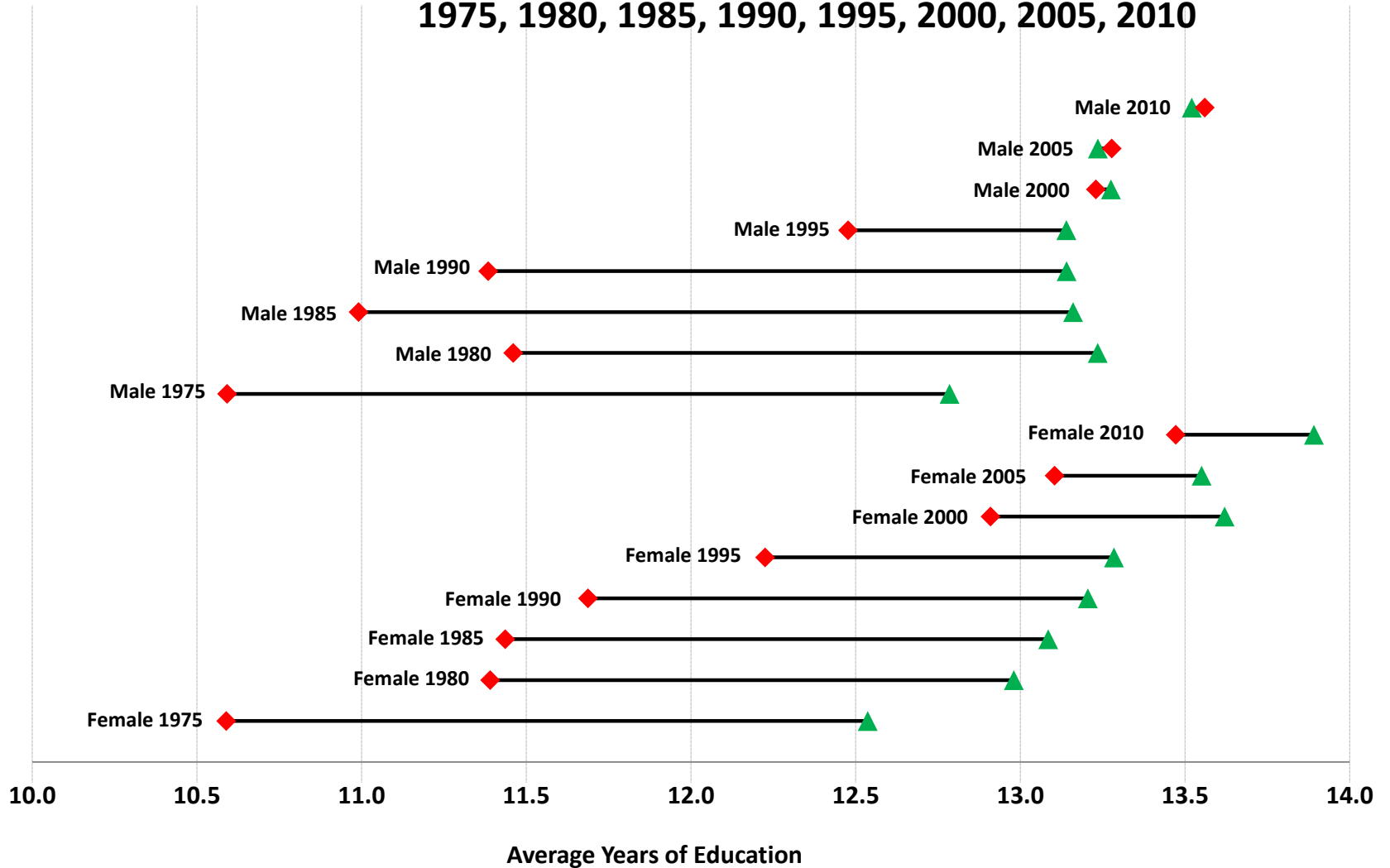


55-64 years old

United States Educational Attainment Comparisons by Gender

Ages 25-34 vs. ages 55-64

1975, 1980, 1985, 1990, 1995, 2000, 2005, 2010



25-34 years old

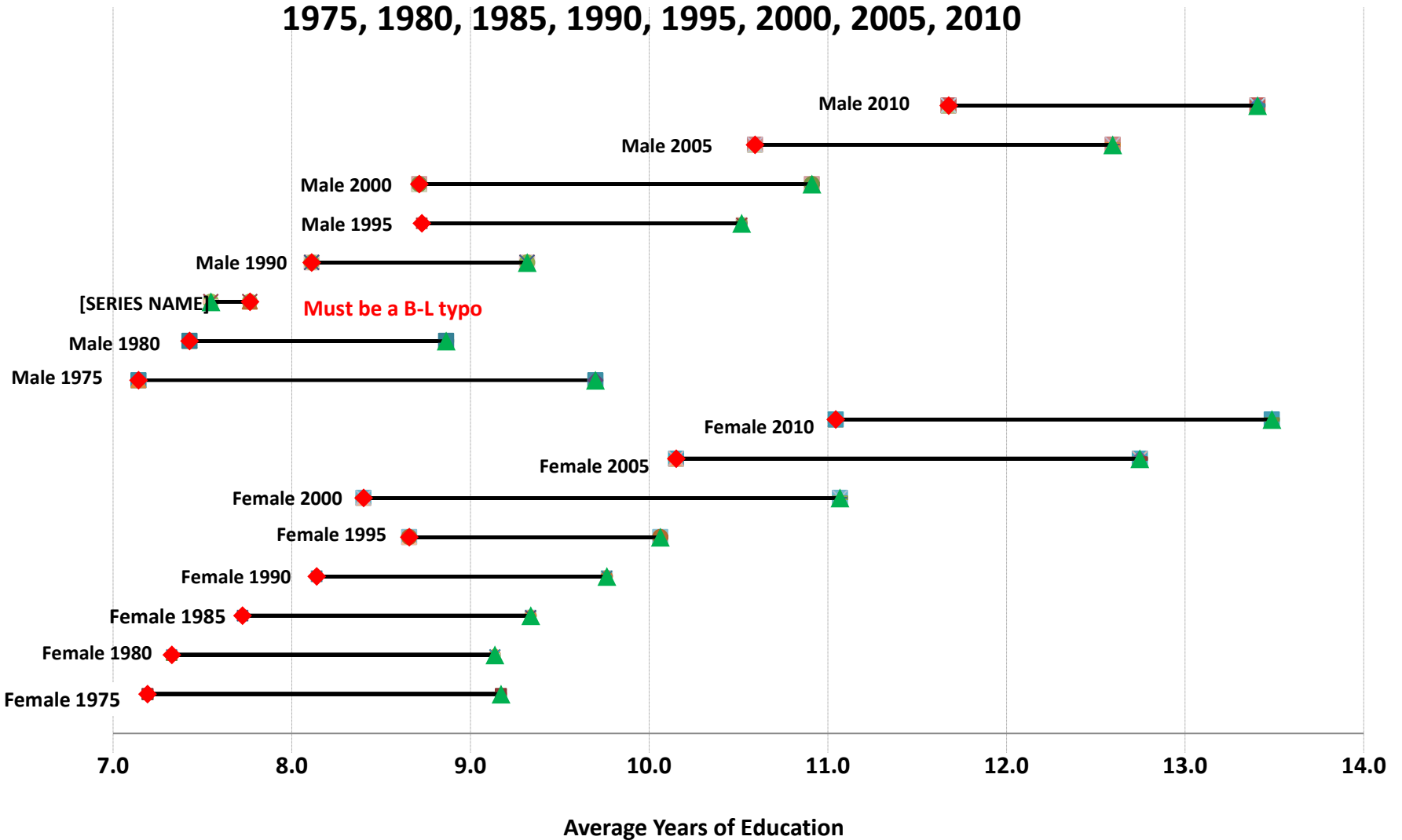


55-64 years old

United Kingdom Education Attainment Comparisons

Ages 25-34 vs. ages 55-64

1975, 1980, 1985, 1990, 1995, 2000, 2005, 2010



25-34 years old



55-64 years old

Why J-F Human Capital?

- **For market human capital:**
 - **Considers the lifetime of a working individual, not just what is happening today**
 - **Recognizes the current and future benefit of education**
 - **Human capital as a stock of wealth of a country, yielding economic benefits today and in the future**
- **Nonmarket human capital does the same for unpaid activities**

Jorgenson-Fraumeni Human Capital

- The J-F lifetime income approach applies the neoclassical theory of investment (Jorgenson, 1967) to human capital.
- According to this theory, the price of capital goods depends upon the discounted value of all future capital services derived from the investments.
- On a per capita basis, this means that the value of the human capital of an individual can be determined from that person's discounted lifetime income.

J-F Human Capital

- **World Bank, 141 countries, February 2018**
- **UNECE guide human capital option 2016**
- **OECD, 18 countries 2011**
- **UNEP & Urban Institute (at Kyushu University) conventional approach 140 countries 2018 – general lifetime**
- **A number of individual country J-F implementations**

Historical & Recent Papers

- **J & F, Accumulation of human and nonhuman capital, 1948-1984 (1989)**
- **Fraumeni, Christian & Samuels, Accumulation, revisited, covers 1948-84 and 1998-2009 (2017)**
- **Fraumeni & Christian, Accumulation, an analysis by gender, 1975-2012, IARIW August conference (2018, forthcoming)**
- **Fraumeni, Christian & Samuels, Accumulation, the long view, 1948-2013, in progress**

Jorgenson-Fraumeni

- The following sets of data for a J-F simplified approach (Fraumeni 2008) as implemented by Liu (2011) are required, except as noted for ages 15 through 64, and gender
 - 1) working age population,
 - 2) survival rates,
 - 3) school enrollment rates for ages 15 through 29 by single year, ages 30-34 and 35-39 by five year categories, and 40 and above,
 - 4) educational attainment, and
 - 5) annual earnings.

Jorgenson-Fraumeni

- 4 life stages, with variables
 - *mi*: Expected lifetime market income per capita, discounted to the present
 - *R*: The adjustment factor applied to lifetime income
 - = $(1 + \text{real rate of growth on labor income}) / (1 + \text{real discount rate})$
 - = 1.02/1.04
 - *sr*: Survival rate
 - *senr*: Formal school enrolment rate and
 - *y_{mi}*: Yearly market income per capita.
- For subscripts:
 - *a*: Age
 - *e*: Highest level of education completed
 - *enr*: Formal education enrollment level
 - *older*: Equal to $a + 1$
 - *s*: Gender, and
 - *school*: Equal to $e + 1$.

Stages

1: No work, no school

2: School, but no work

3: School and work both possible

4: Work only

5: Retirement, no school or work

Jorgenson-Fraumeni

- Stage 3: Work and school, ages 15 through 34, when an individual could be enrolled in school and data is available

$$mi(s,a,e) = ymi(s,a,e) + [senr(s,a,enr) * sr(s,older) * mi(s,older,school) + (1-senr(s,a,enr)) * sr(s,older) * mi(s,older,e)] * R$$

- $R = \frac{(1 + \text{real rate of growth on labor income})}{(1 + \text{real discount rate})}$

Jorgenson-Fraumeni

- Stage 1: No work or school, ages 0 to 5

$$mi(s,a,e)=sr(s,older)*mi(s,older,e)*R$$

- Stage 2: School, no work, ages 6-14

$$mi(s,a,e)=$$

$$[senr(s,a,enr)*sr(s,older)*mi(s,older,school)$$

$$+(1-senr(s,a,enr))*sr(s,older)*mi(s,older,e)]*R$$

- $school=e+1$; $older=a+1$

Jorgenson-Fraumeni

- Stage 4: Work, no school, ages 35 through 74
 $mi(s,a,e) = ymi(s,a,e) + sr(s,older) * mi(s,older,e)$
- Stage 5: No work, no school, age 75
 $mi(s,a,e) = 0.0$

Jorgenson-Fraumeni

- **Recursive backwards calculations**
- **Assumed that the relative wage rates by educational attainment levels are determined by the contemporaneous relative wage rates, survival rates, and enrollment rates**

2012 Production in the U.S.

J-F Market Human Capital Only

		billions	percent
	Gross private domestic product (NIPA definition)	14,008	63%
	Gross private domestic product (adjusted)	14,219	64%
+	Investment in market human capital, births	3,340	15%
+	Investment in market human capital, education, net of aging	4,080	18%
+	Investment in market human capital, residual	704	3%
=	Expanded gross private domestic product	22,343	100%

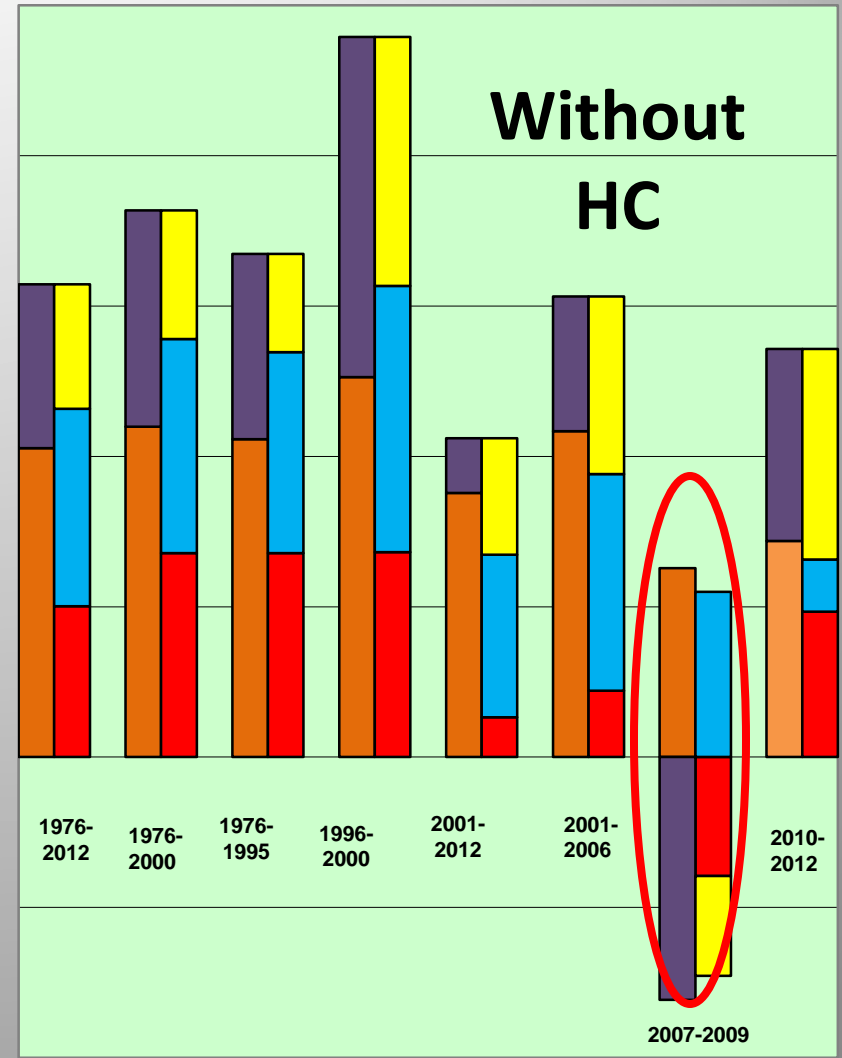
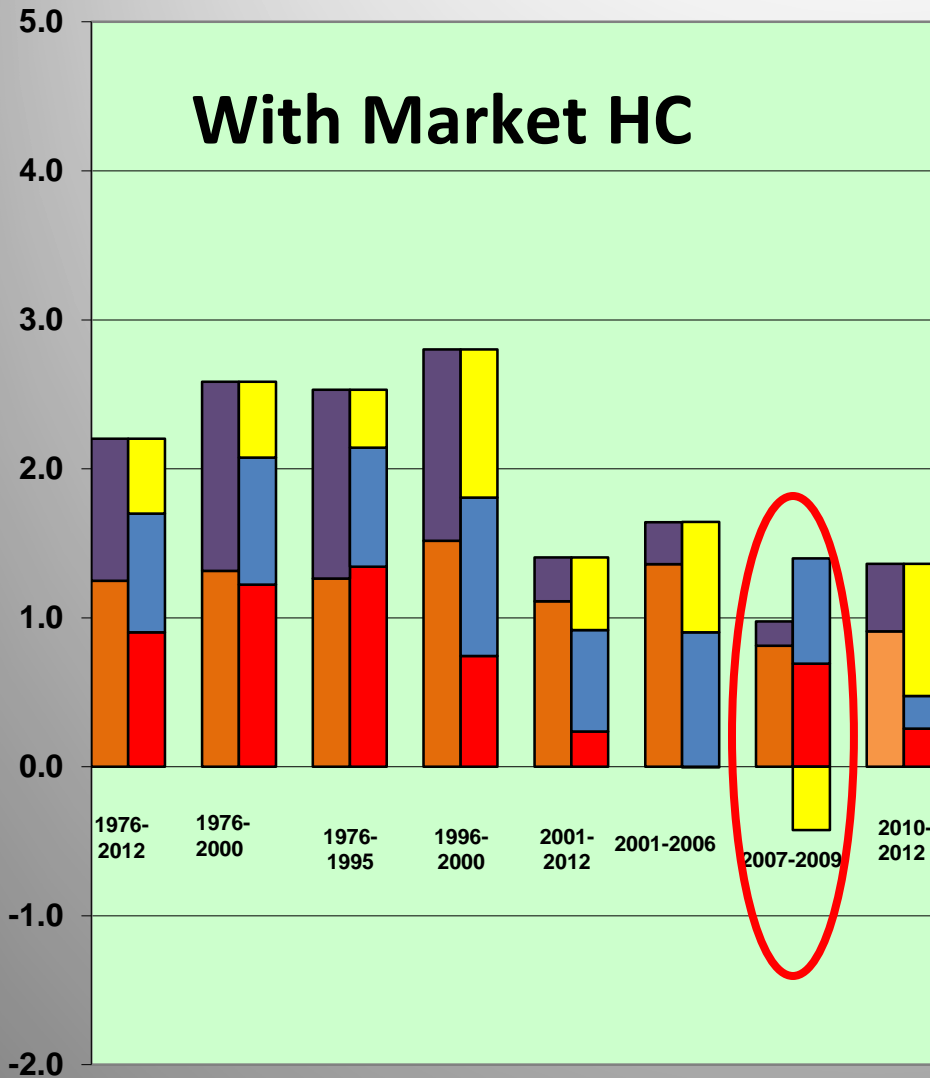
Impact of Human Capital on Growth

- Real HC determined by population growth, increasing levels of education and wage growth as reflected in lifetime income weights
- Annually from 1975-2012, compared to real GDP (2.9%), population (1.04%), educational attainment (.4%) and wage growth (assumed 2%), all grow slowly

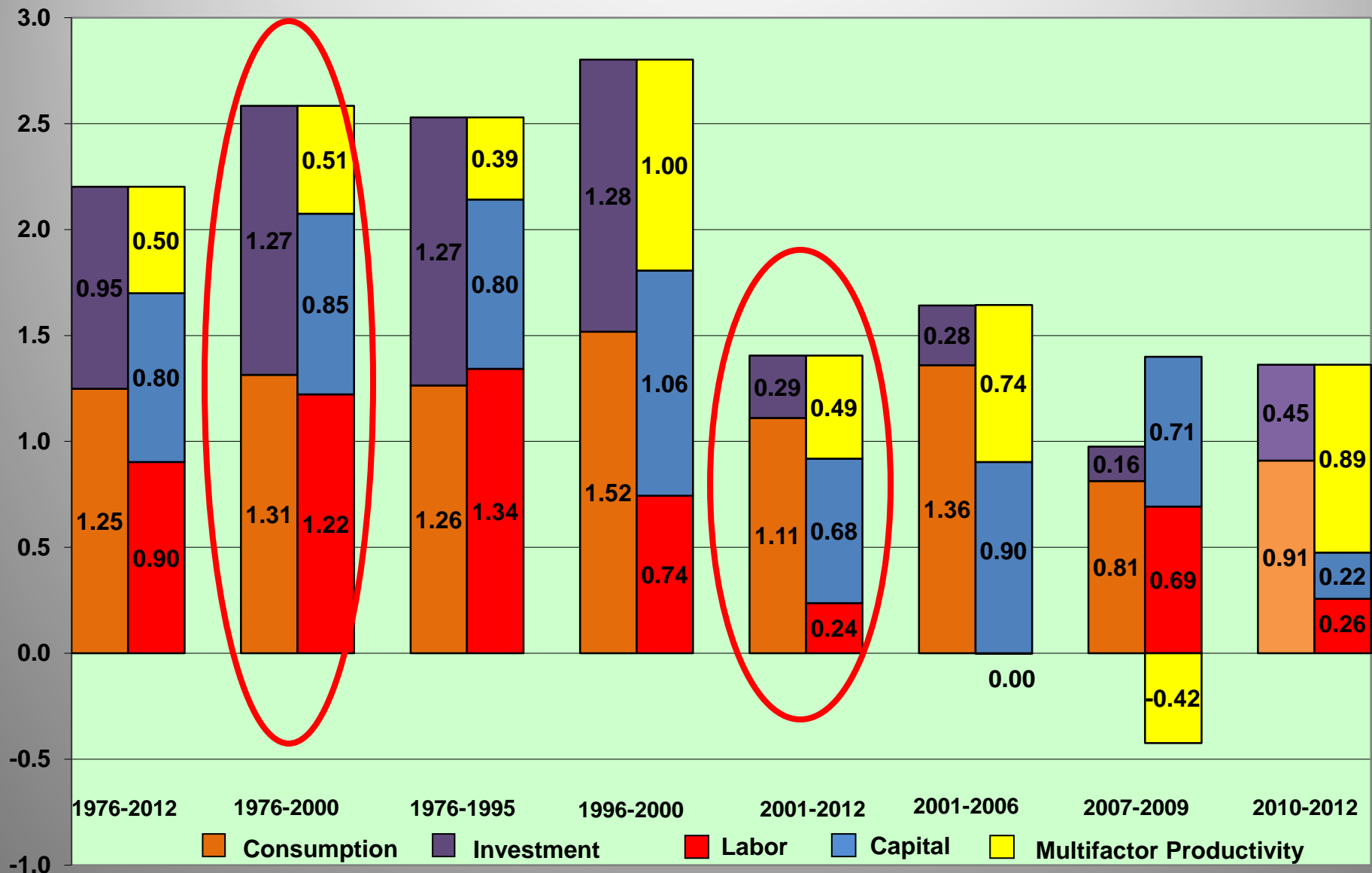
With vs. Without HC

- **1975-2012**
 - Without HC contributions are about 40% higher
 - Without HC ROG of MFP are about 65% higher
- **2007-2009**
 - Substantially higher enrollments in tertiary education
 - Only ROG of MFP with HC is still negative, but is a much smaller negative

Contributions



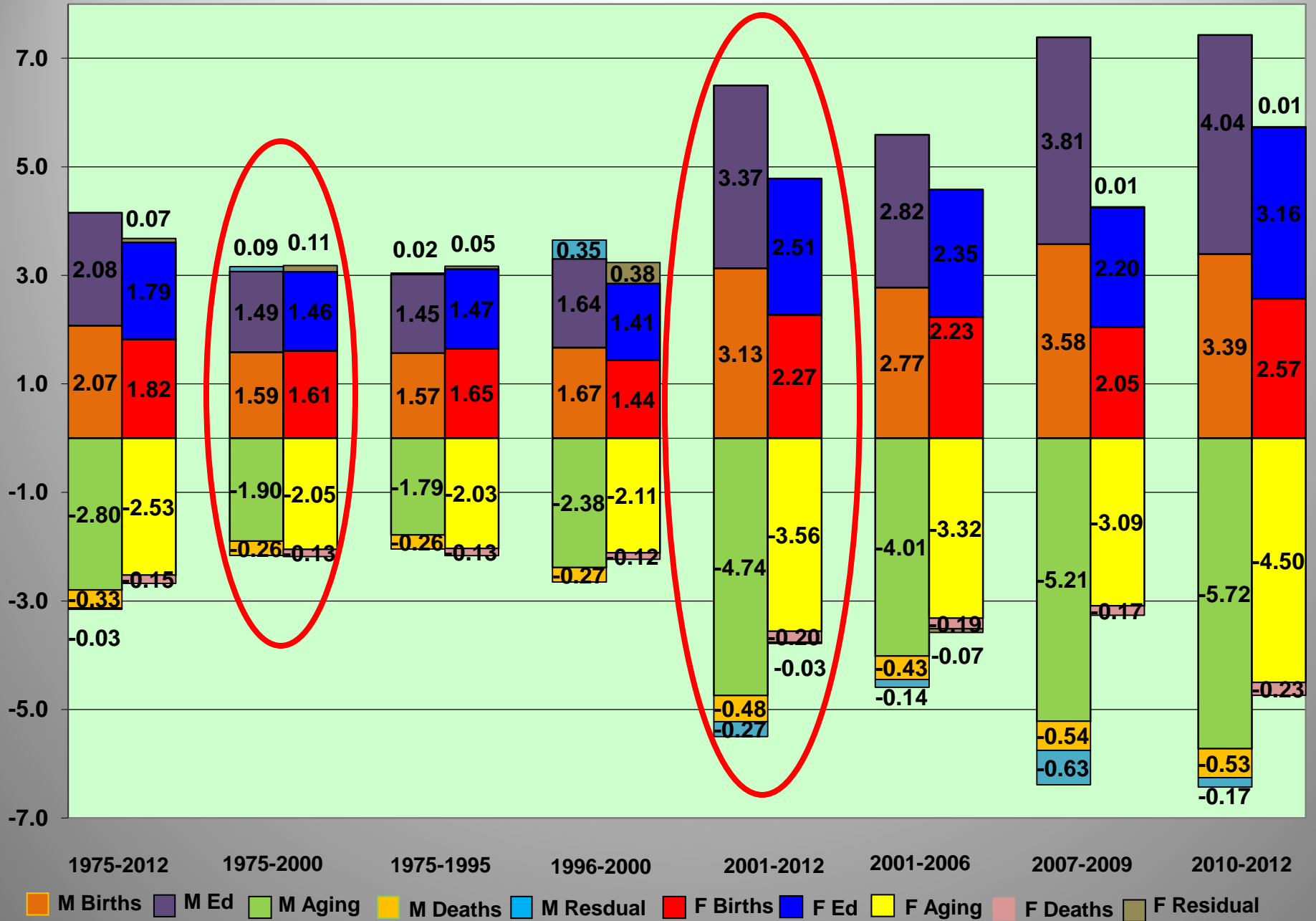
Contributions to Expanded Market Gross Private Domestic Product and Economic Growth with Human Capital



Shares of Real Investment by Gender

- **Very small shares are all deaths or residual**
- **Big difference between 1975-2000 and 2001-2012**
- **In 2001-2012**
 - **Positive and negative shares both getting larger**
 - **Male education, net of aging, and aging consistently getting larger**
 - **Other shares show a less consistent trend**

Shares of Market Real Net Investment by Gender 1975-2012 (Percent divided by 100)



Conclusion

J-F lifetime income HC accounts

- **Allow a detailed demographic analysis of human capital**
- **Recognize the importance of today and the future**
- **Can be translated into the underlying causes more easily recognized by government officials, policy-makers, researchers, and the general public**