Capital is Back: Wealth-Income Ratios in Rich Countries, 1700-2010

Thomas Piketty & Gabriel Zucman
Paris School of Economics
March 2013

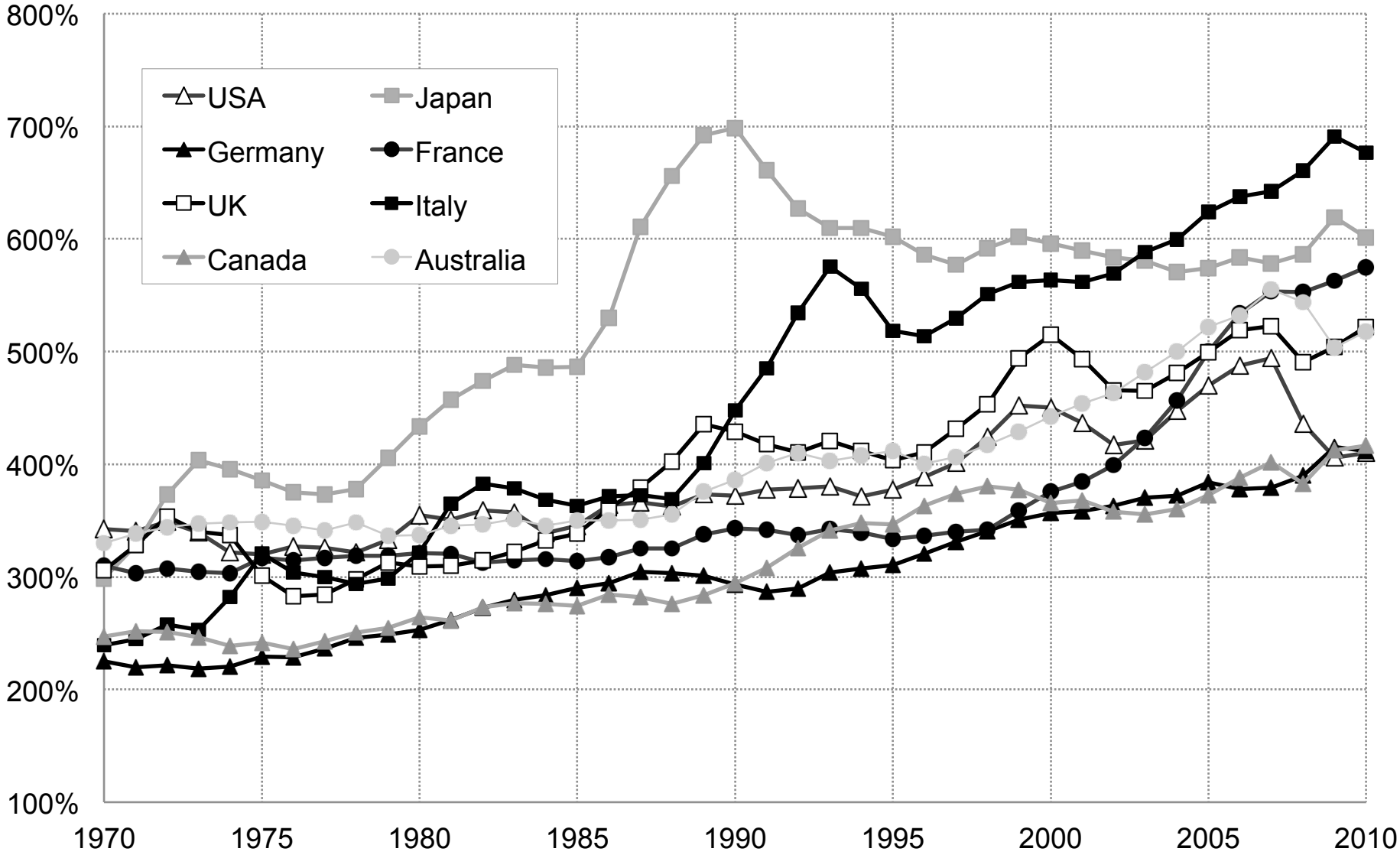
How Do Aggregate Wealth-Income Ratios Evolve in the Long Run, and Why?

- Impossible to address this basic question until recently: national accounts were mostly about flows, not stocks

- **We compile a new dataset to address this question:**

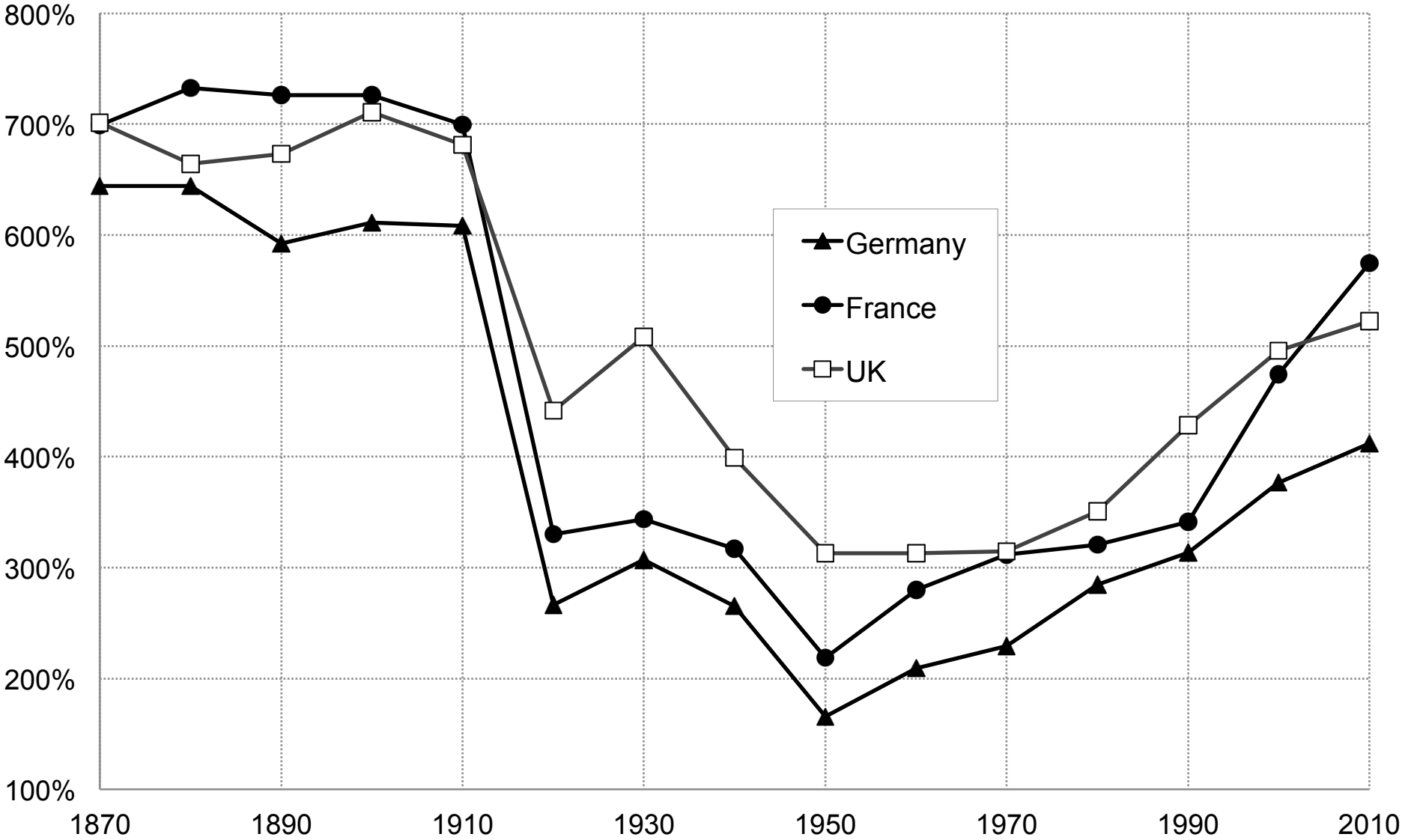
  - **1970-2010**: Official balance sheets for US, Japan, Germany, France, UK, Italy, Canada, Australia
  - **1870-**: Historical estimates for US, Germany, France, UK
  - **1700-**: Historical estimates for France, UK

We Find a Gradual Rise of Private Wealth-National Income Ratios over 1970-2010



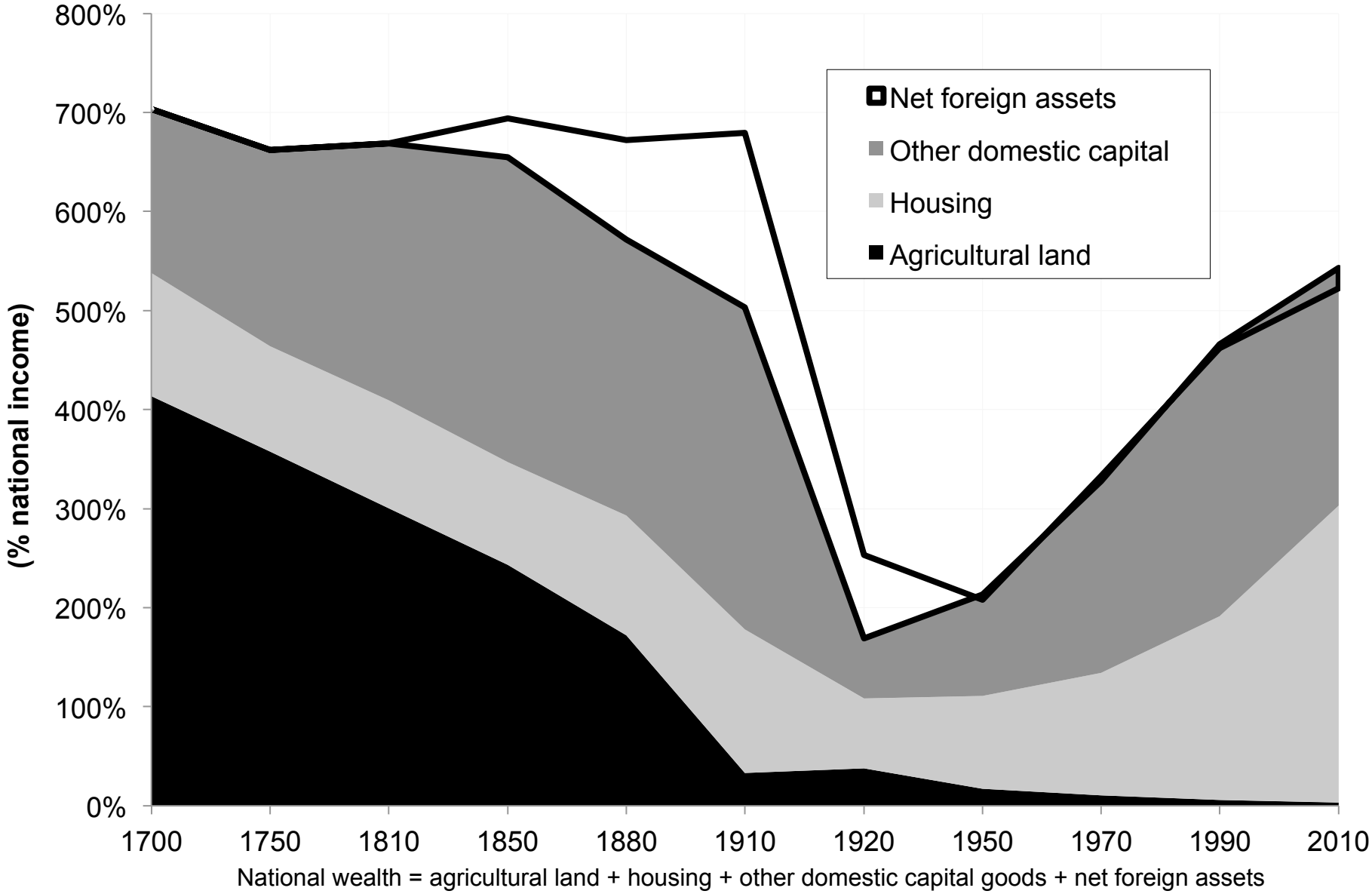
Authors' computations using country national accounts. Private wealth = non-financial assets + financial assets - financial liabilities (household & non-profit sectors)

European Wealth-Income Ratios Appear to be Returning to Their High 18c-19c Values…

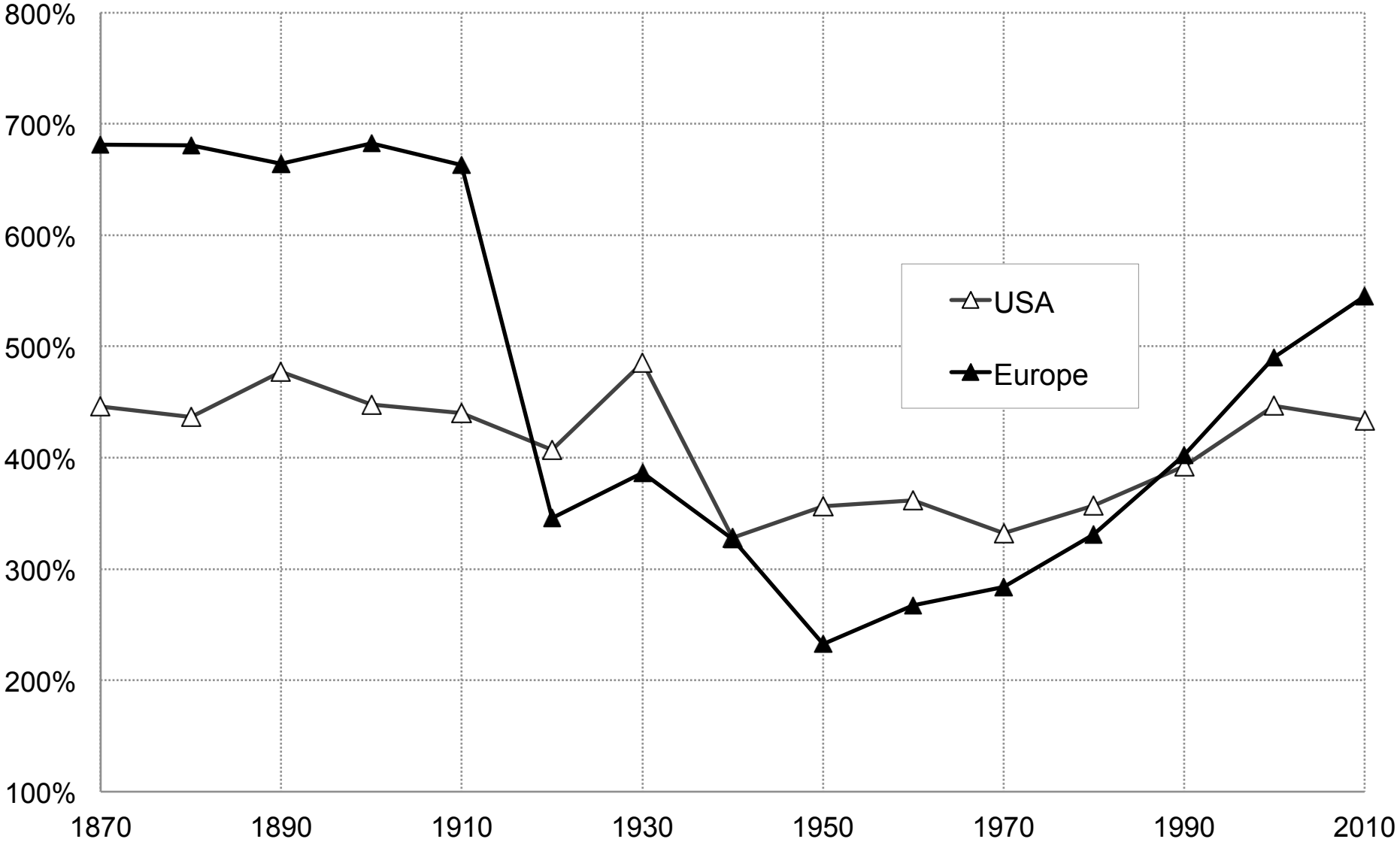


Authors' computations using country national accounts. Private wealth = non-financial assets + financial assets - financial liabilities (household & non-profit sectors)

…Despite Considerable Changes in the Nature of Wealth: UK, 1700-2010



In the US, the Wealth-Income Ratio Also Followed a U-Shaped Evolution, But Less Marked



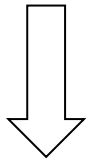
Authors' computations using country national accounts. Private wealth = non-financial assets + financial assets - financial liabilities (household & non-profit sectors)

How Can We Explain the 1970-2010 Evolution?

1. **An asset price effect**: long run asset price recovery driven by changes in capital policies since world wars

2. **A real economic effect**: slowdown of productivity and pop growth:

   – Harrod-Domar-Solow: wealth-income ratio $\boldsymbol{\beta = s/g}$
   – If saving rate s = 10% and growth rate g = 3%, then $\beta \approx 300\%$
   – But if s = 10% and g = 1.5%, then $\beta \approx 600\%$

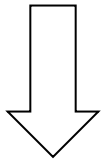


Countries with low *g* are bound to have high *β*.
Strong effect in Europe, ultimately everywhere.

How Can We Explain Return to 19c Levels?

In very long run, limited role of asset price divergence

- In short/medium run, war destructions & valuation effects paramount
- But in the very long run, no significant divergence between price of consumption and capital goods
- Key long-run force is $\beta = s/g$

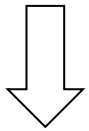


One sector model accounts reasonably well for long run dynamics & level differences Europe vs. US

Lesson 1: Capital is Back

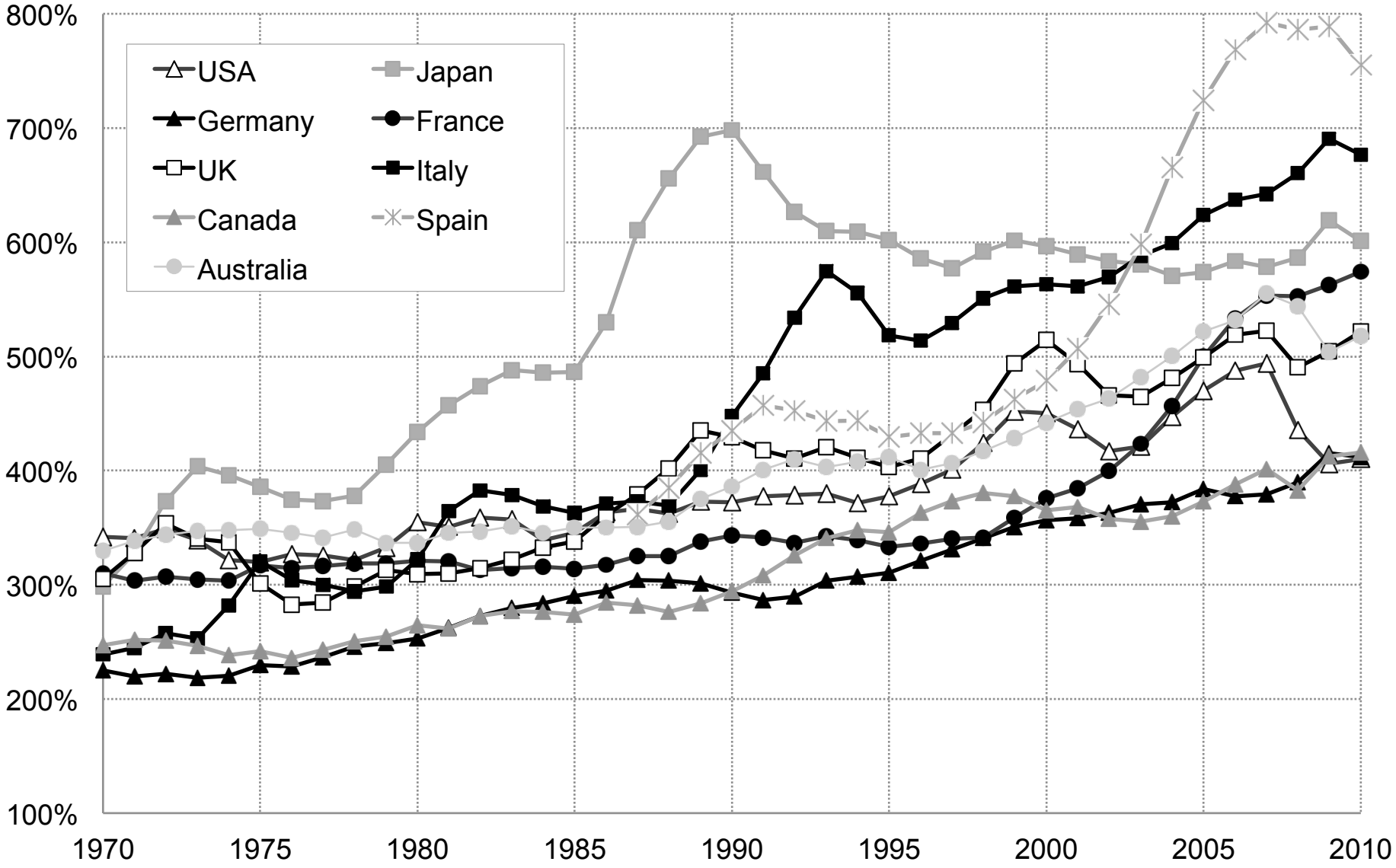
- **Low β in mid-20c were an anomaly**
  - Anti-capital policies depressed asset prices
  - Unlikely to happen again with free markets
  - Who owns wealth will become again very important

- **β can vary a lot between countries**
  - *s* and *g* determined by different forces
  - With perfect markets: scope for very large net foreign asset positions
  - With imperfect markets: domestic asset price bubbles



High β raise new issues about capital regulation & taxation

Private Wealth-National Income Ratios, 1970-2010, including Spain



Authors' computations using country national accounts. Private wealth = non-financial assets + financial assets - financial liabilities (household & non-profit sectors)

Lesson 2: The Changing Nature of Wealth and Technology

- **In 21st century: $\sigma > 1$**
  - Rising β come with decline in average return to wealth r
  - But decline in r smaller than increase in β → capital shares $\alpha = r\beta$ increase

  → Consistent with K/L elasticity of substitution $\sigma > 1$

- **In 18th century: $\sigma < 1$**
  - In 18c, K = mostly land
  - In land-scarce Old World, $\alpha \approx 30\%$
  - In land-rich New World, $\alpha \approx 15\%$

  → Consistent with $\sigma < 1$: when low substitutability, α large when K relatively scarce

Roadmap

1. Wealth-income β ratios: concepts and methods
2. Sources of 1970-2010 rise in β
3. Analysis of 1870-2010 dynamics of β
4. The changing nature of wealth, 1700-2010
5. Lessons for the shape of the production function & other perspectives

1. Wealth-Income Ratios: Concepts and Methods

The Wealth and Income Concepts We Use

- **Wealth**
  - Private wealth W = assets - liabilities of households
  - Corporations valued at market prices through equities
  - Government wealth W_g
  - National wealth $W_n = W + W_g$
  - National wealth $W_n = K$ (land + housing + other domestic capital) + NFA (net foreign assets)

- **Income**
  - Domestic output $Y_d = F(K,L)$ (net of depreciation)
  - National income Y = domestic output $Y_d + r\,NFA$
  - Capital share $\alpha = r\beta$ (r = average rate of return)

$\beta = W/Y$ = private wealth-national income ratio

$\beta_n = W_n/Y$ = national wealth-national income ratio

Accounting for Wealth Accumulation: One Good Model

In any one-good model:

- At each date t: $W_{t+1} = W_t + s_t Y_t$
  $\rightarrow \quad \beta_{t+1} = \beta_t \, (1+g_{wst})/(1+g_t)$

  - $1+g_{wst} = 1+s_t/\beta_t$ = saving-induced wealth growth rate
  - $1+g_t = Y_{t+1}/Y_t$ = output growth rate (productivity + pop.)

- In steady state, with fixed saving rate $s_t=s$ and growth rate $g_t=g$:
  $\boldsymbol{\beta_t \rightarrow \beta = s/g}$ (Harrod-Domar-Solow formula)

  - Example: if s = 10% and g = 2%, then β = 500%

Accounting for Wealth Accumulation: One Good Model

***β = s/g is* a pure accounting formula**, i.e. valid wherever *s* comes from:

- Wealth or bequest in the utility function: saving rate *s* set by *u()* (intensity of wealth or bequest taste) and/or demographic structure; $\beta = s/g$ follows
- Dynastic utility: rate of return *r* set by *u()*; if α set by technology, then $\beta = \alpha/r$ follows ($s = \alpha g/r$, so $\beta = \alpha/r = s/g$)
- With general utility functions, both *s* and *r* are jointly determined by *u()* and technology

Accounting for Wealth Accumulation: Two Goods Model

Two goods: one capital good, one consumption good

- Define $1+q_t$ = real rate of capital gain (or loss)

= excess of asset price inflation over consumer price inflation

- Then $\beta_{t+1} = \beta_t\,(1+g_{wst})(1+q_t)/(1+g_t)$

  - $1+g_{wst} = 1+s_t/\beta_t$ = saving-induced wealth growth rate
  - $1+q_t$ = capital-gains-induced wealth growth rate

Our Empirical Strategy

- We do not specify where q_t come from
  - maybe stochastic production functions for capital vs. consumption good, with different rates of technical progress

- We observe $\beta_t, \ldots, \beta_{t+n}$

  $s_t, \ldots, s_{t+n}$

  $g_t, \ldots, g_{t+n}$

and we decompose the wealth accumulation equation between years t and $t + n$ into:

- Volume effect (saving) vs.
- Price effect (capital gain or loss)

2. Sources of the 1970-2010 Rise in Wealth-Income Ratio

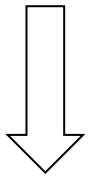
Data Sources and Method, 1970-2010

- **Official annual balance sheets for top 8 rich countries:**
  - Assets (incl. non produced) and liabilities at market value
  - Based on census-like methods: reports from financial institutions, housing surveys, etc.
  - Known issues (e.g., tax havens) but better than PIM

- **Extensive decompositions & sensitivity analysis:**
  - Private vs. national wealth
  - Domestic capital vs. foreign wealth
  - Private (personal + corporate) vs. personal saving
  - Multiplicative vs. additive decompositions
  - R&D

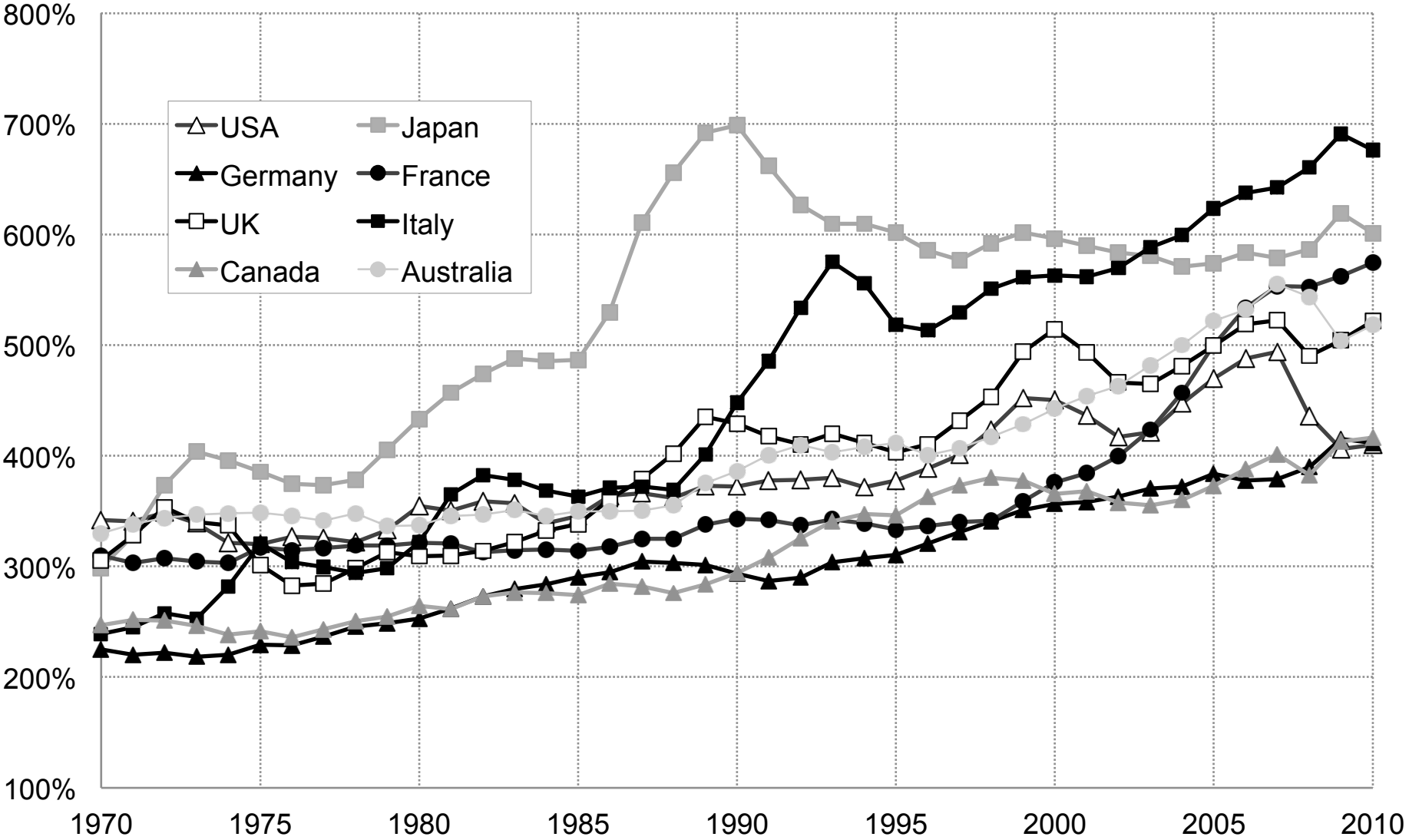
1970-2010: A Low Growth and Asset Price Recovery Story

- **Key results of the 1970-2010 analysis:**
  - Non-zero capital gains
  - Account for significant part of 1970-2010 increase
  - But significant increase in β would have still occurred without K gains, just because of *s* & *g*



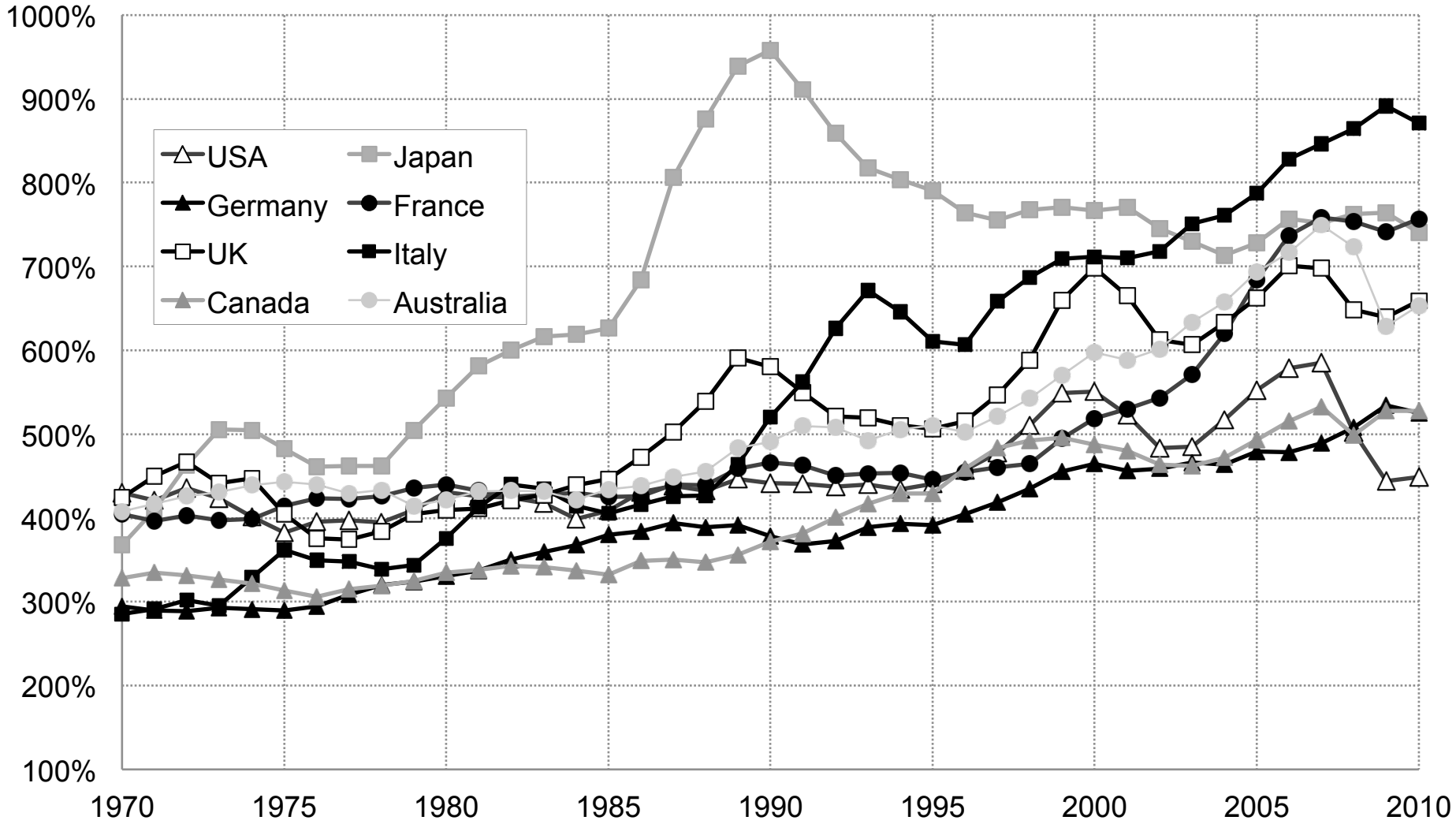
The rise in β is more than a bubble

What We Are Trying to Understand: The Rise in Private Wealth-National Income Ratios, 1970-2010



Authors' computations using country national accounts. Private wealth = non-financial assets + financial assets - financial liabilities (household & non-profit sectors)

NB: The Rise Would be Even More Spectacular Should We Divide Wealth by Disposable Income



Authors' computations using country national accounts. Private wealth = non-financial assets + financial assets - financial liabilities (household & non-profit sectors)

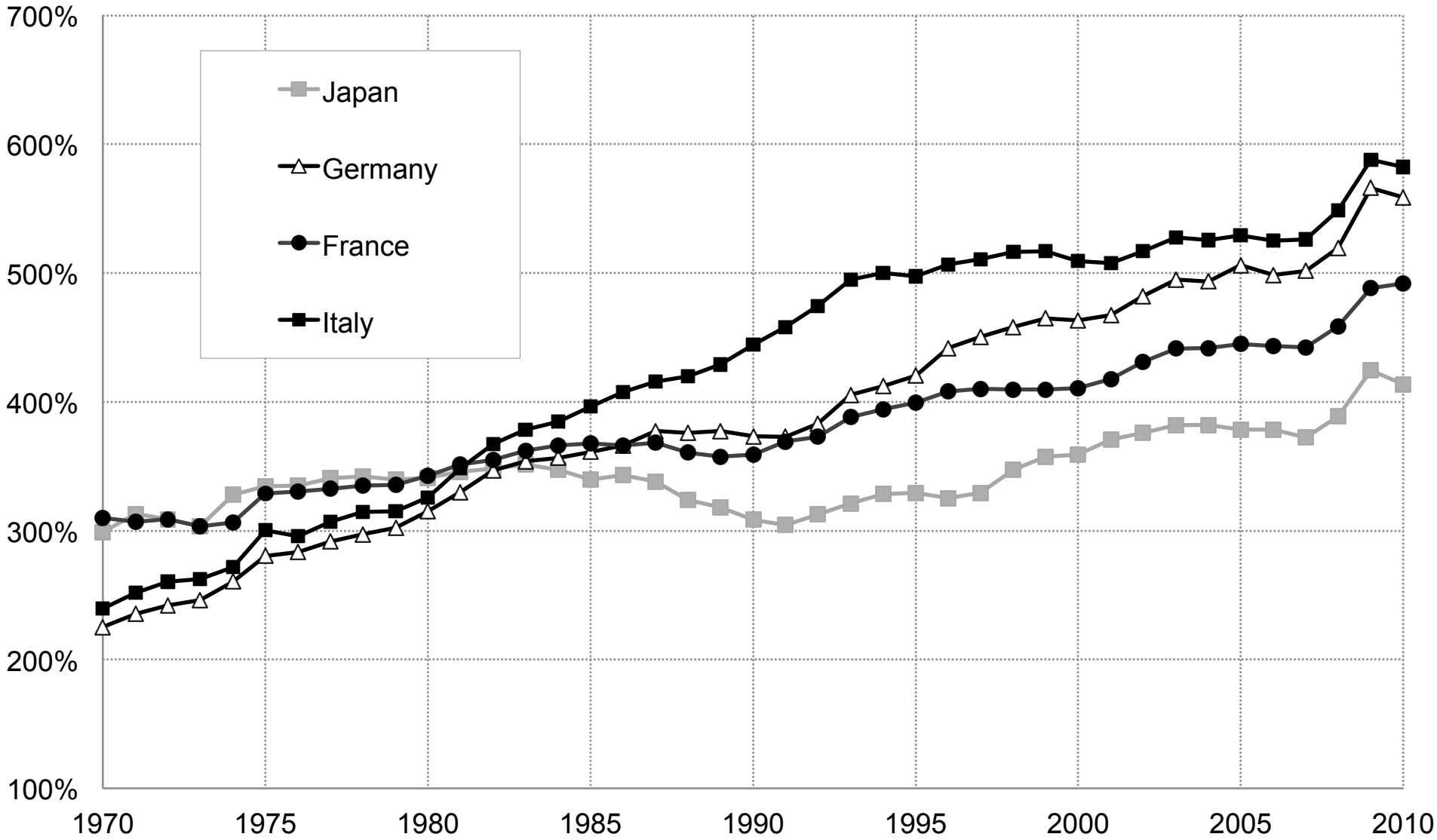
Growth Rates and Private Saving Rates in Rich Countries, 1970-2010

	Real growth rate of national income	Population growth rate	Real growth rate of per capita national income	**Net private saving rate** (personal + corporate) (% national income)
U.S.	**2.8%**	1.0%	1.8%	**7.7%**
Japan	**2.5%**	0.5%	2.0%	**14.6%**
Germany	**2.0%**	0.2%	1.8%	**12.2%**
France	**2.2%**	0.5%	1.7%	**11.1%**
U.K.	**2.2%**	0.3%	1.9%	**7.3%**
Italy	**1.9%**	0.3%	1.6%	**15.0%**
Canada	**2.8%**	1.1%	1.7%	**12.1%**
Australia	**3.2%**	1.4%	1.7%	**9.9%**

A Pattern of Small, Positive Capital Gains on Private Wealth…

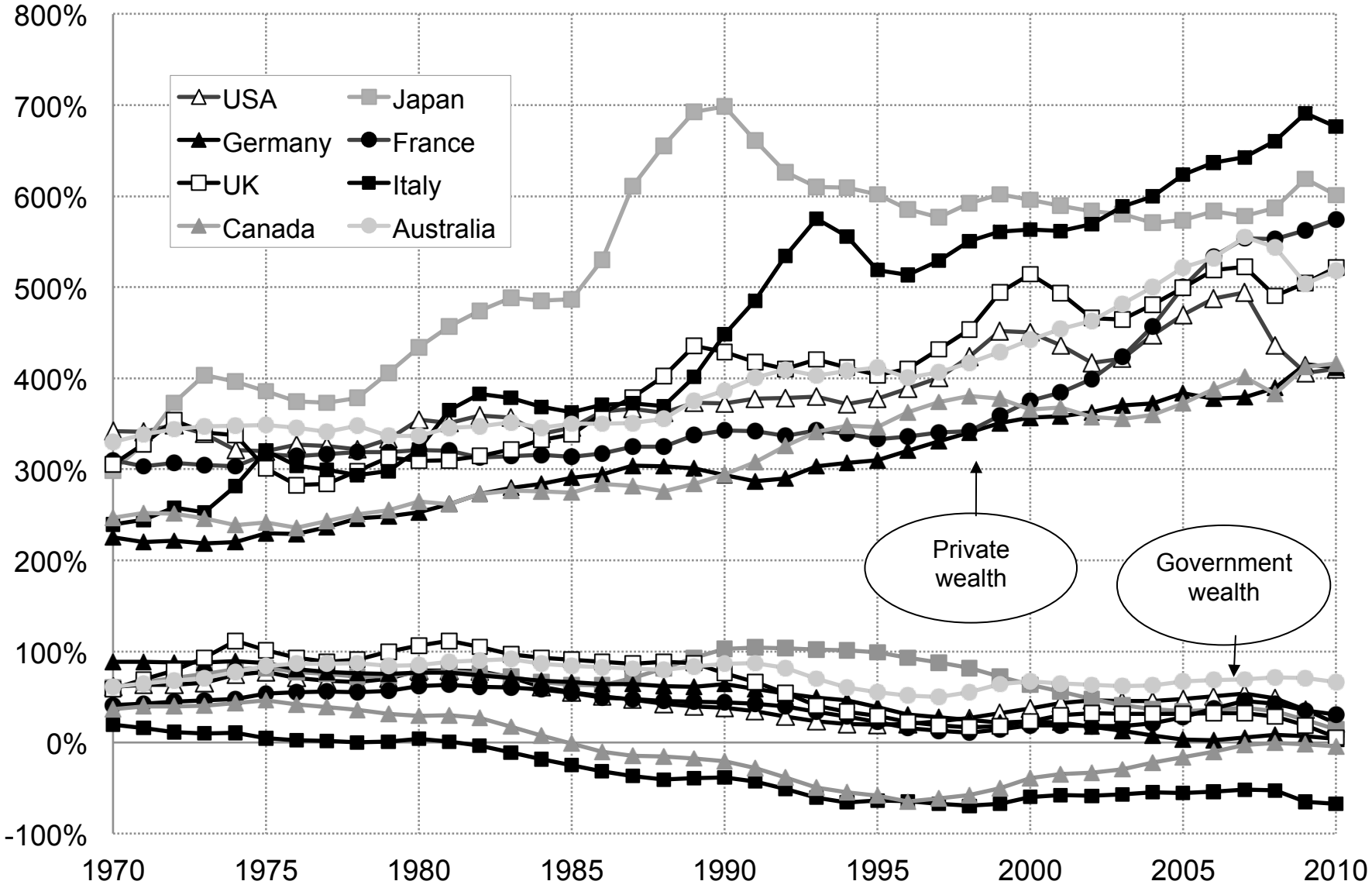
	Private wealth-national income ratios		Decomposition of 1970-2010 wealth growth rate		
	β (1970)	β (2010)	Real growth rate of private wealth g_w	Savings-induced wealth growth rate $g_{ws} = s/\beta$	Capital-gains-induced wealth growth rate q
U.S.	342%	410%	3.3%	2.9% ***88%***	0.4% ***12%***
Japan	299%	601%	4.3%	3.4% ***78%***	0.9% ***22%***
Germany	225%	412%	3.5%	4.3% ***121%***	-0.8% ***-21%***
France	310%	575%	3.8%	3.4% ***90%***	0.4% ***10%***
U.K.	306%	522%	3.6%	1.9% ***55%***	1.6% ***45%***
Italy	239%	676%	4.6%	4.2% ***92%***	0.4% ***8%***
Canada	247%	416%	4.2%	4.3% ***103%***	-0.1% ***-3%***
Australia	330%	518%	4.4%	3.4% ***79%***	0.9% ***21%***

… But Private Wealth / National Income Ratios Would Have Increased Without K Gains in Low Growth Countries



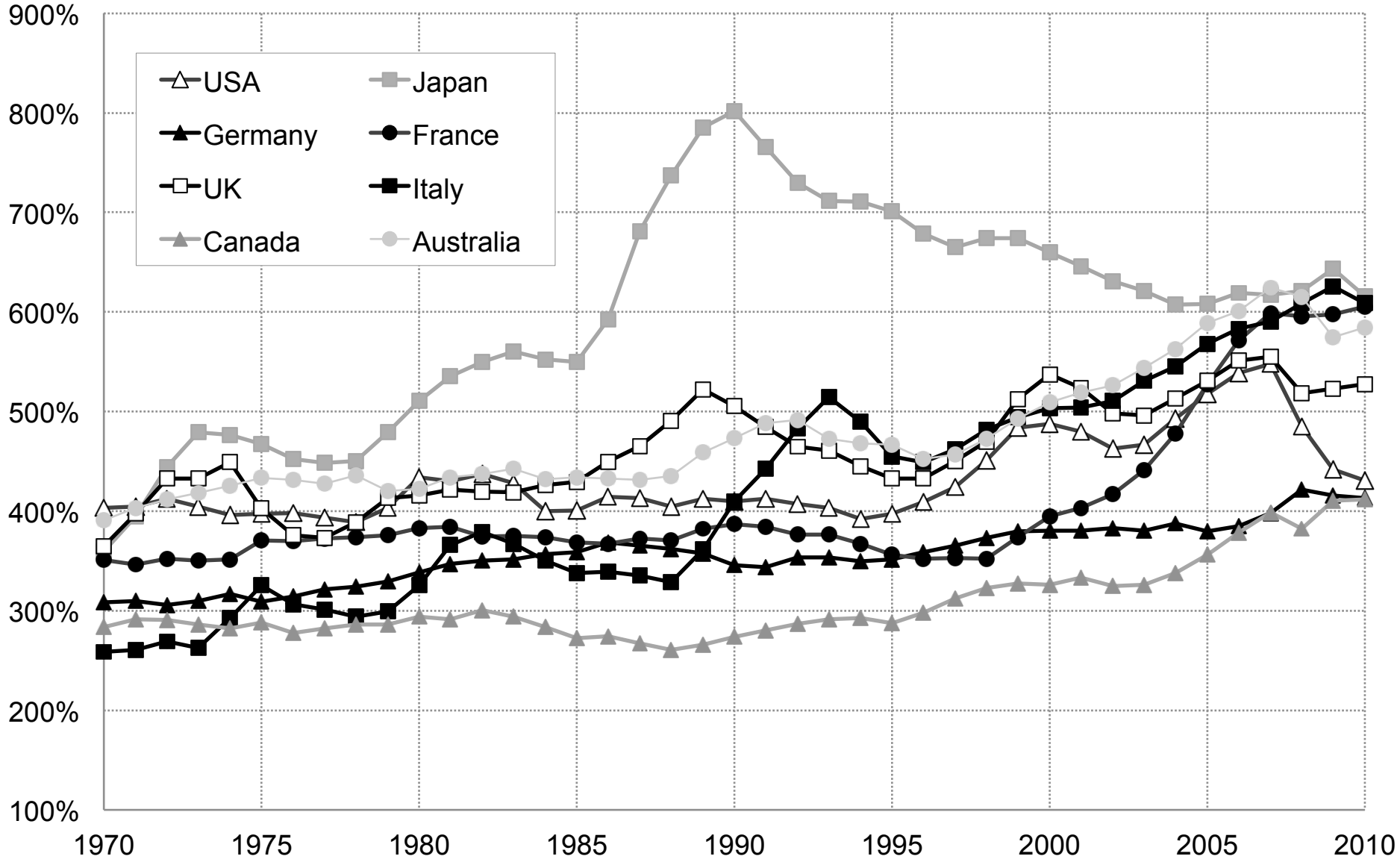
Simulated private wealth / national income ratios in the absence of valuation changes, based on 1970 wealth-income ratios, 1970-2010 private saving flows (including other volume changes) and real income growth rates

From Private to National Wealth: Small and Declining Government Net Wealth, 1970-2010



Authors' computations using country national accounts. Government wealth = non-financial assets + financial assets - financial liabilities (govt sector)

Decline in Gov Wealth Means National Wealth Has Been Rising a Bit Less than Private Wealth



Authors' computations using country national accounts. National wealth = private wealth + government wealth

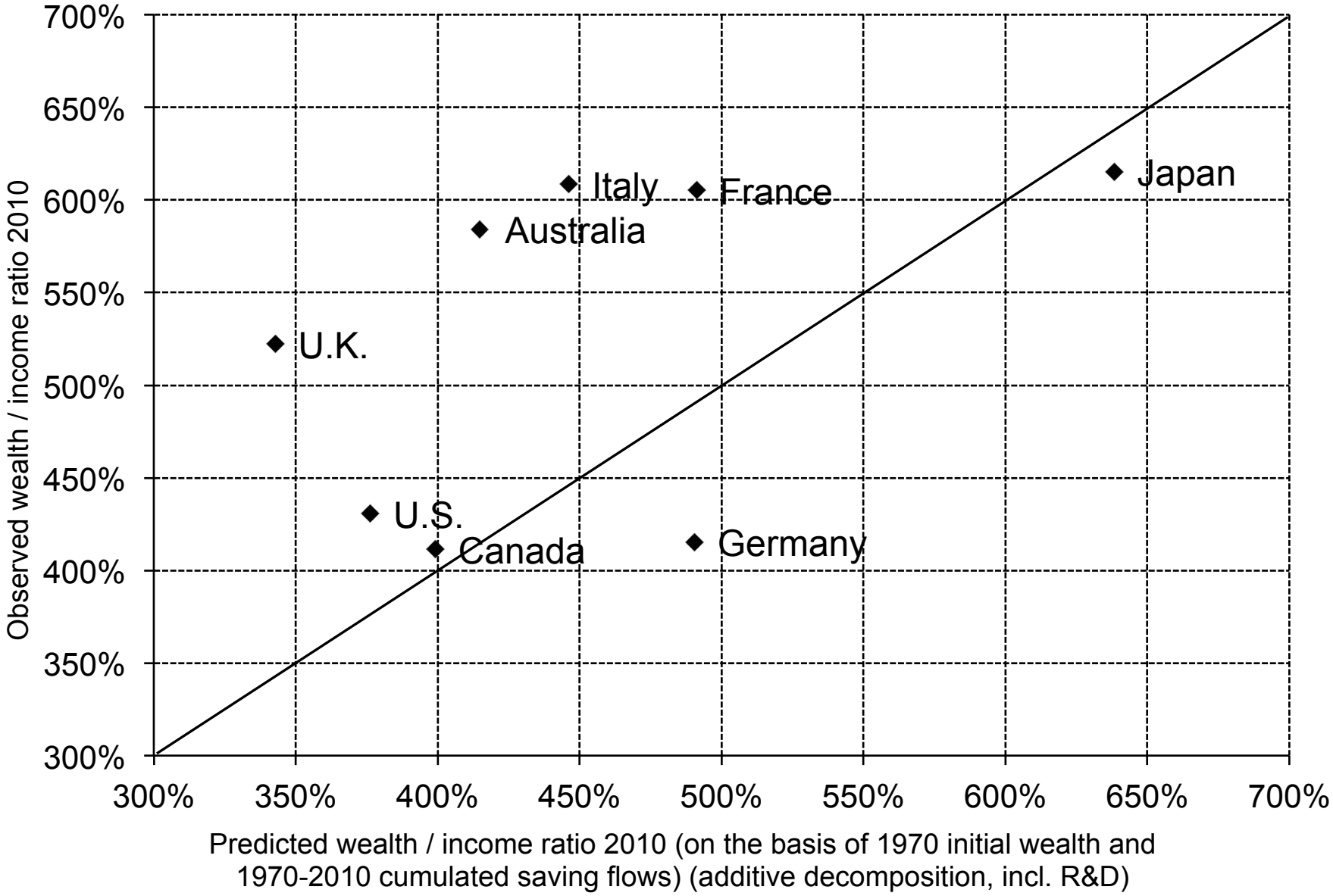
National Saving 1970-2010: Private vs Government

Average saving rates 1970-2010 (% national income)	Net national saving (private + government)	incl. private saving	incl. government saving
U.S.	5.2%	7.7%	-2.4%
Japan	14.6%	14.6%	0.0%
Germany	10.2%	12.2%	-2.1%
France	9.2%	11.1%	-1.9%
U.K.	5.3%	7.3%	-2.0%
Italy	8.5%	15.0%	-6.5%
Canada	10.1%	12.1%	-2.0%
Australia	8.9%	9.9%	-0.9%

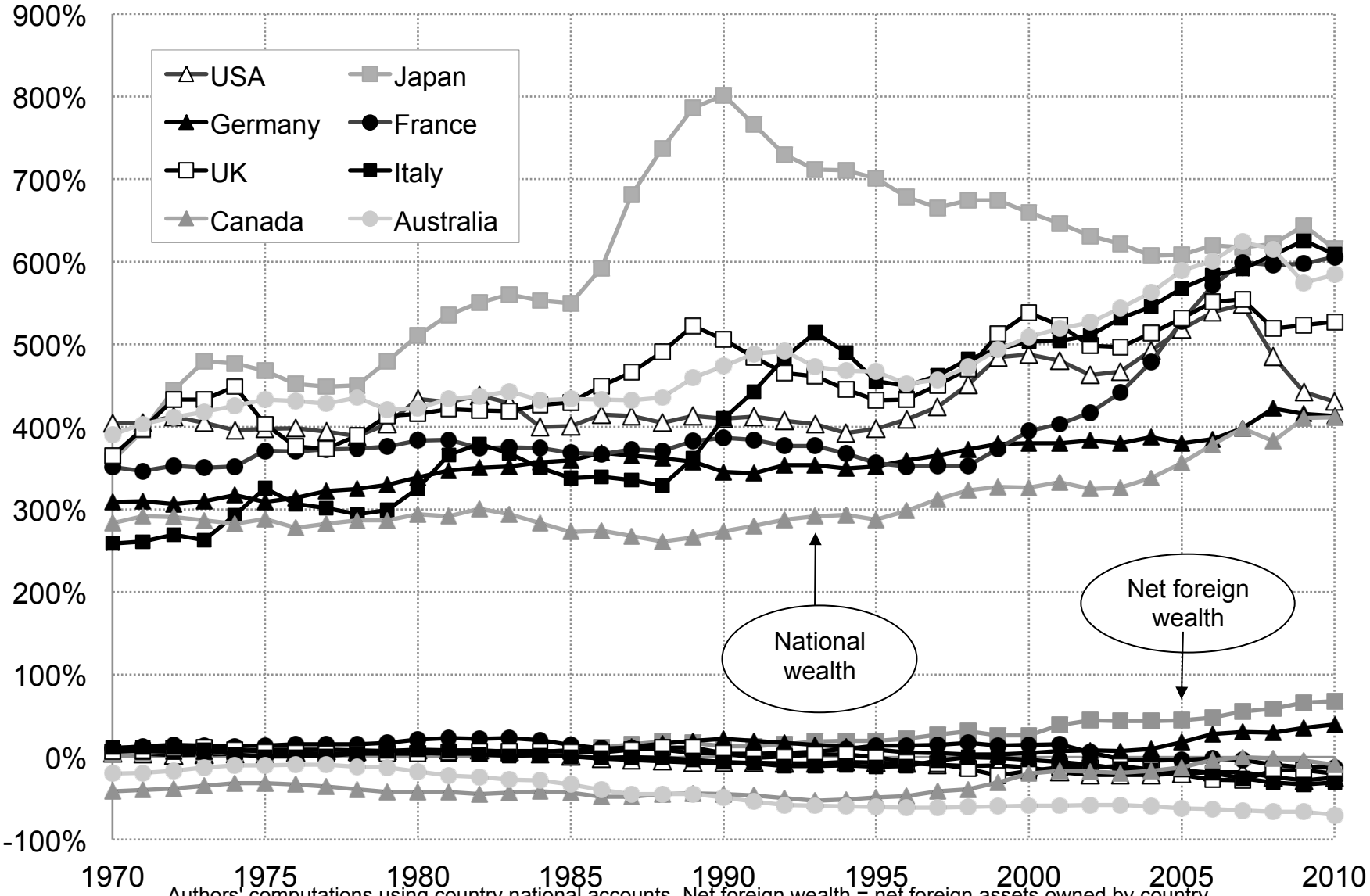
Robust Pattern of Positive Capital Gains on National Wealth

	National wealth-national income ratios		Decomposition of 1970-2010 wealth growth rate		
			Real growth rate of national wealth	Savings-induced wealth growth rate	Capital-gains-induced wealth growth rate
	β (1970)	β (2010)	g_w	$g_{ws} = s/\beta$	q
U.S.	404%	431%	3.0%	2.1% ***72%***	0.8% ***28%***
Japan	359%	616%	3.9%	3.1% ***78%***	0.8% ***22%***
Germany	313%	416%	2.7%	3.1% ***114%***	-0.4% ***-14%***
France	351%	605%	3.6%	2.7% ***75%***	0.9% ***25%***
U.K.	346%	523%	3.3%	1.5% ***45%***	1.8% ***55%***
Italy	259%	609%	4.1%	2.6% ***63%***	1.5% ***37%***
Canada	284%	412%	3.8%	3.4% ***89%***	0.4% ***11%***
Australia	391%	584%	4.2%	2.5% ***61%***	1.6% ***39%***

Pattern of Positive Capital Gains on National Wealth Largely Robust to Inclusion of R&D



National vs. Foreign Wealth, 1970-2010 (% National Income)



Authors' computations using country national accounts. Net foreign wealth = net foreign assets owned by country residents in rest of the world (all sectors)

The Role of Foreign Wealth Accumulation in Rising β

	National wealth / national income ratio (1970)		National wealth / national income ratio (2010)		Rise in national wealth / national income ratio (1970-2010)	
	incl. Domestic capital	incl. Foreign wealth	incl. Domestic capital	incl. Foreign wealth	incl. Domestic capital	incl. Foreign wealth
U.S.	**404%**		**431%**		**27%**	
	399%	4%	456%	-25%	57%	-30%
Japan	**359%**		**616%**		**256%**	
	356%	3%	548%	67%	192%	64%
Germany	**313%**		**416%**		**102%**	
	305%	8%	377%	39%	71%	31%
France	**351%**		**605%**		**254%**	
	340%	11%	618%	-13%	278%	-24%
U.K.	**365%**		**527%**		**163%**	
	359%	6%	548%	-20%	189%	-26%
Italy	**259%**		**609%**		**350%**	
	247%	12%	640%	-31%	392%	-42%
Canada	**284%**		**412%**		**128%**	
	325%	-41%	422%	-10%	97%	31%
Australia	**391%**		**584%**		**194%**	
	410%	-20%	655%	-70%	244%	-50%

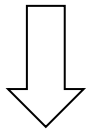
Housing Has Played an Important Role in Many But Not All Countries

	Domestic capital / national income ratio (1970)		Domestic capital / national income ratio (2010)		Rise in domestic capital / national income ratio (1970-2010)	
	incl. Housing	incl. Other domestic capital	incl. Housing	incl. Other domestic capital	incl. Housing	incl. Other domestic capital
U.S.	**399%** 142%	257%	**456%** 182%	274%	**57%** 41%	17%
Japan	**356%** 131%	225%	**548%** 220%	328%	**192%** 89%	103%
Germany	**305%** 129%	177%	**377%** 241%	136%	**71%** 112%	-41%
France	**340%** 104%	236%	**618%** 371%	247%	**278%** 267%	11%
U.K.	**359%** 98%	261%	**548%** 300%	248%	**189%** 202%	-13%
Italy	**247%** 107%	141%	**640%** 386%	254%	**392%** 279%	113%
Canada	**325%** 108%	217%	**422%** 208%	213%	**97%** 101%	-4%
Australia	**410%** 172%	239%	**655%** 364%	291%	**244%** 193%	52%

Conclusion on 1970-2010 Evolution

- Diversity of national trajectories
  - Housing (France, UK, Italy, Australia)
  - Accumulation of foreign holdings (Japan, Germany)
  - Low vs. high population growth
  - Low vs. high equity valuations (Germany vs. UK/US)

- Increasing dispersion and volatility in β ($\neq$ Kaldor)
- Some measurement issues
- But overall robust pattern of moderate capital gains



We need to put 1970-2010 period into longer perspective

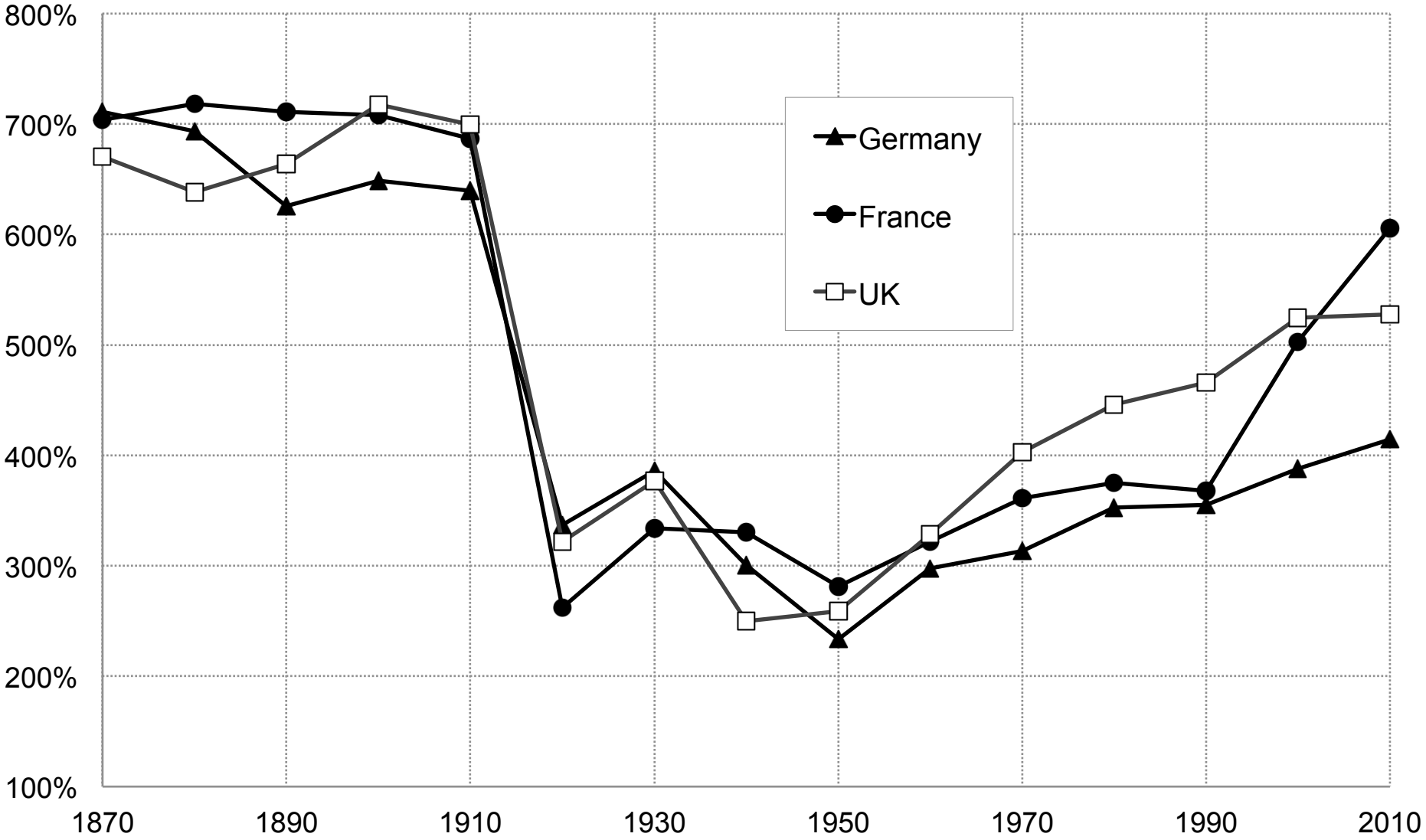
3. The 1870-2010 Dynamics of Wealth-Income Ratios

Data Sources and Method, 1870-2010

- **We use historical balance sheets:**
  - Vibrant tradition of wealth accounts before WWI
  - UK: Colquhoun, Giffen, Bowley…
  - France: Foville, Colson…
  - To some extent easier to measure wealth in 18c-19c
  - Annual series 1870-2010; by sector

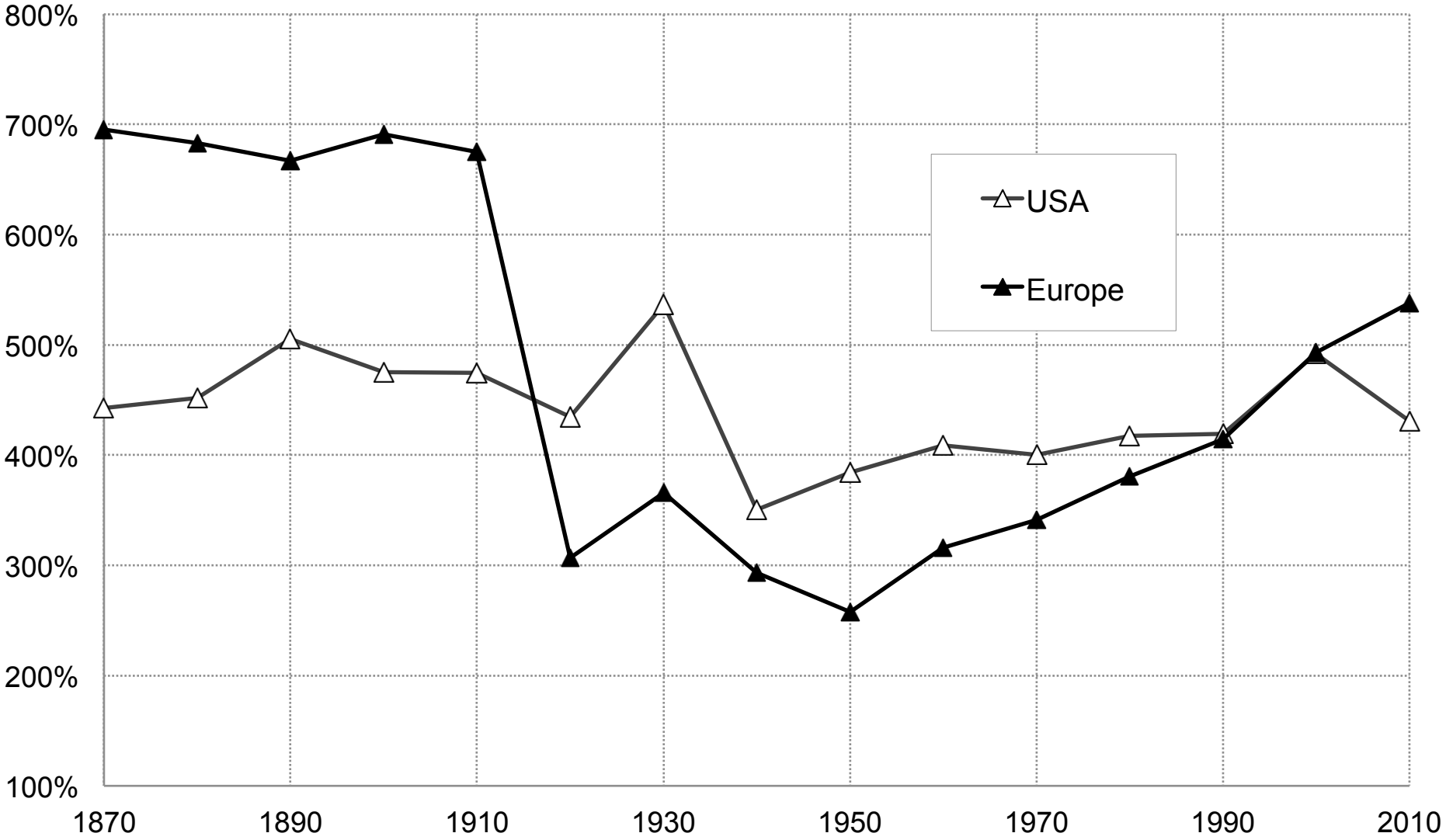
- **Main conclusions of 1870-2010 analysis:**
  - Chaotic 20c: wars, valuation losses
  - But over 1870-2010 capital gains/losses seem to wash out
  - In long run, changes in wealth-income ratios seem well accounted for by $\beta = s/g$

National Wealth / National Income Ratios in Europe, 1870-2010



Authors' computations using country national accounts. National wealth = private wealth (household & non-profit sectors) + government wealth

National Wealth / National Income Ratios, 1870-2010: Europe vs. US



Authors' computations using country national accounts. National wealth = private wealth (household & non-profit sectors) + government wealth

Growth Rate vs National Saving Rate in Rich Countries, 1870-2010

	Real growth rate of national income	Population growth rate	Real growth rate of per capita national income	**Net national saving** (private + gov.) (% national income)
U.S.	**3.4%**	1.5%	1.9%	**9.7%**
Germany	**2.3%**	0.5%	1.7%	**11.3%**
France	**2.1%**	0.4%	1.7%	**8.8%**
U.K.	**1.9%**	0.5%	1.4%	**7.2%**

Accumulation of National Wealth in Rich Countries, 1870-2010: The Limited Role of Capital Gains

	National wealth-national income ratios		Decomposition of 1870-2010 wealth growth rate		
			Real growth rate of wealth	Savings-induced wealth growth rate (incl. destruc.)	Capital-gains-induced wealth growth rate
	β (1870)	β (2010)	g_w	$g_{ws} = s/\beta$	q
U.S.	413%	431%	3.4%	2.6% ***76%***	0.8% ***24%***
Germany	759%	416%	2.0%	2.3% ***114%***	-0.3% ***-14%***
France	689%	605%	2.0%	1.7% ***86%***	0.3% ***14%***
U.K.	656%	523%	1.8%	1.5% ***87%***	0.2% ***13%***

Accumulation of National Wealth in France, 1870-2010

	national wealth-national income ratios		Real growth rate of national wealth	Savings-induced wealth growth rate (incl. destruc.)	Capital-gains-induced wealth growth rate
	β_t	β_{t+n}	g_w	$g_{ws} = s/\beta$	q
1870-2010	689%	605%	2.0%	1.7% **86%**	0.3% **14%**
1870-1910	689%	745%	1.3%	1.3% **100%**	0.0% **0%**
1910-2010	745%	605%	2.3%	1.8% **82%**	0.4% **18%**
1910-1950	745%	254%	-1.2%	-0.7% **52%**	-0.6% **48%**
1950-1980	254%	383%	6.0%	4.9% **83%**	1.0% **17%**
1980-2010	383%	605%	3.4%	2.2% **65%**	1.2% **35%**

Accumulation of National Wealth in the UK, 1870-2010

	national wealth-national income ratios		Real growth rate of national wealth	Savings-induced wealth growth rate (incl. destruct.)	Capital-gains-induced wealth growth rate
	β_t	β_{t+n}	g_w	$g_{ws} = s/\beta$	q
1870-2010	656%	527%	1.8%	1.5% **87%**	0.2% **13%**
1870-1910	656%	694%	2.1%	1.7% **79%**	0.4% **21%**
1910-2010	719%	527%	1.6%	1.5% **90%**	0.2% **10%**
1910-1950	719%	241%	-1.3%	0.8% **-58%**	-2.1% **158%**
1950-1980	241%	416%	4.0%	3.0% **76%**	0.9% **24%**
1980-2010	416%	527%	3.4%	1.0% **28%**	2.4% **72%**

Accumulation of National Wealth in Germany, 1870-2010

	national wealth-national income ratios		Real growth rate of national wealth	Savings-induced wealth growth rate	Capital-gains-induced wealth growth rate
	β_t	β_{t+n}	g_w	$g_{ws} = s/\beta$	q
1870-2010	759%	416%	2.0%	2.3% **114%**	-0.3% **-14%**
1870-1910	759%	638%	2.1%	2.2% **108%**	-0.2% **-8%**
1910-2010	638%	416%	2.0%	2.4% **117%**	-0.3% **-17%**
1910-1950	638%	237%	-1.3%	-1.0% **74%**	-0.3% **26%**
1950-1980	237%	330%	6.1%	6.8% **111%**	-0.7% **-11%**
1980-2010	330%	416%	2.5%	2.5% **101%**	0.0% **-1%**

Accumulation of National Wealth in the U.S., 1870-2010

	Market-value national wealth-national income ratios		Real growth rate of national wealth	Savings-induced wealth growth rate	Capital-gains-induced wealth growth rate
	β_t	β_{t+n}	g_w	$g_{ws} = s/\beta$	q
1870-2010	413%	431%	3.4%	2.6% **76%**	0.8% **24%**
1870-1910	413%	469%	4.3%	2.9% **68%**	1.4% **32%**
1910-2010	469%	431%	3.1%	2.5% **80%**	0.6% **20%**
1910-1950	469%	380%	2.7%	2.2% **82%**	0.5% **18%**
1950-1980	380%	434%	4.0%	3.7% **94%**	0.2% **6%**
1980-2010	434%	431%	2.7%	1.6% **58%**	1.1% **42%**

Conclusions 1870-2010

- **There is nothing inherently stable in level of β:**
  - Chaotic dynamics of asset prices1910-1950
  - Huge transfers from private to public wealth in 20c
  - Importance of social rules regarding private property

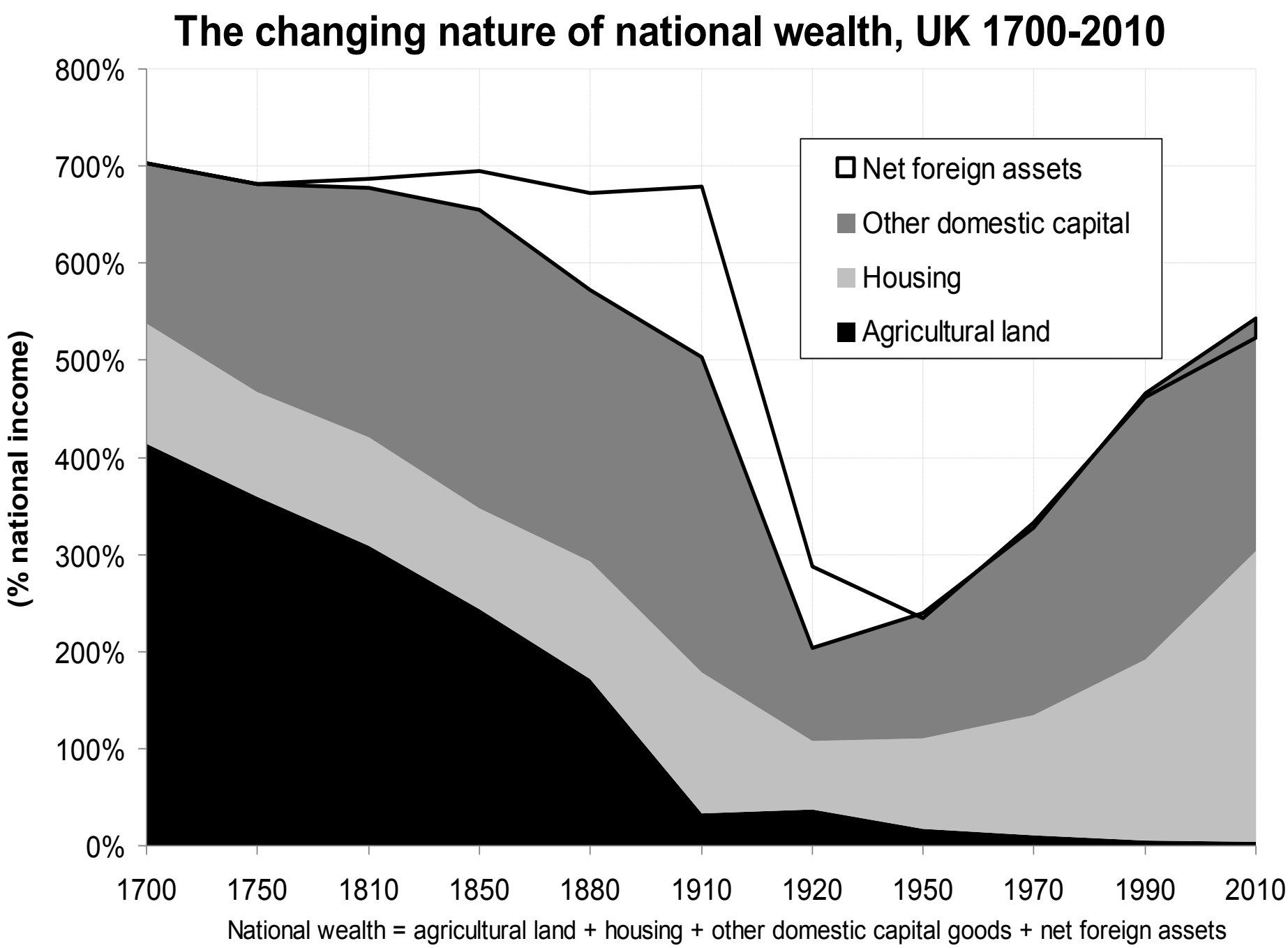
- **Yet at national level and over very long run, $\beta = s/g$**
  - K losses/gains seem to wash out
  - Asset price recovery
  - Consistent with one sector story, despite wealth far from home homogeneous over time

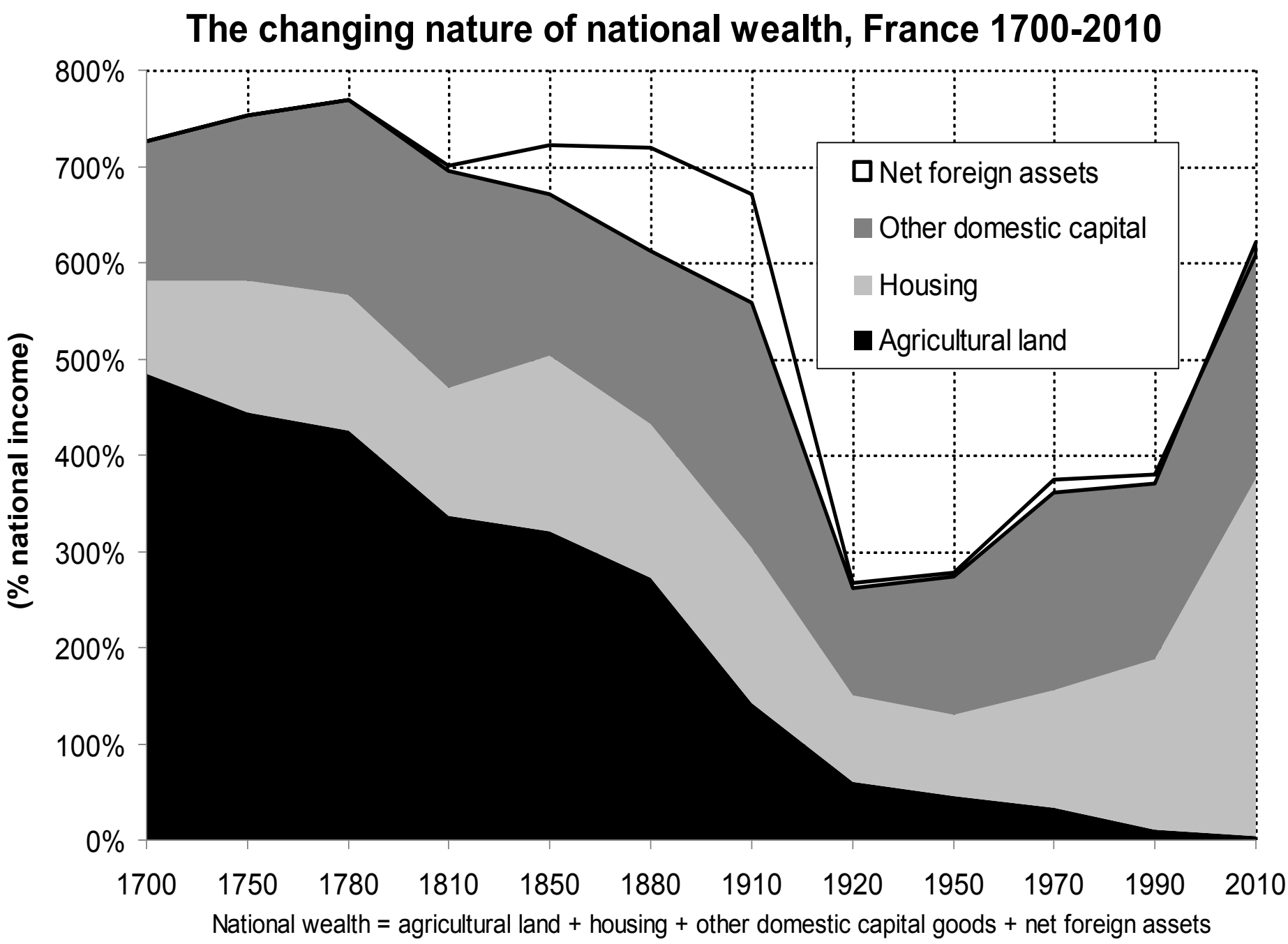
4. The Changing Nature of Wealth, 1700-2010

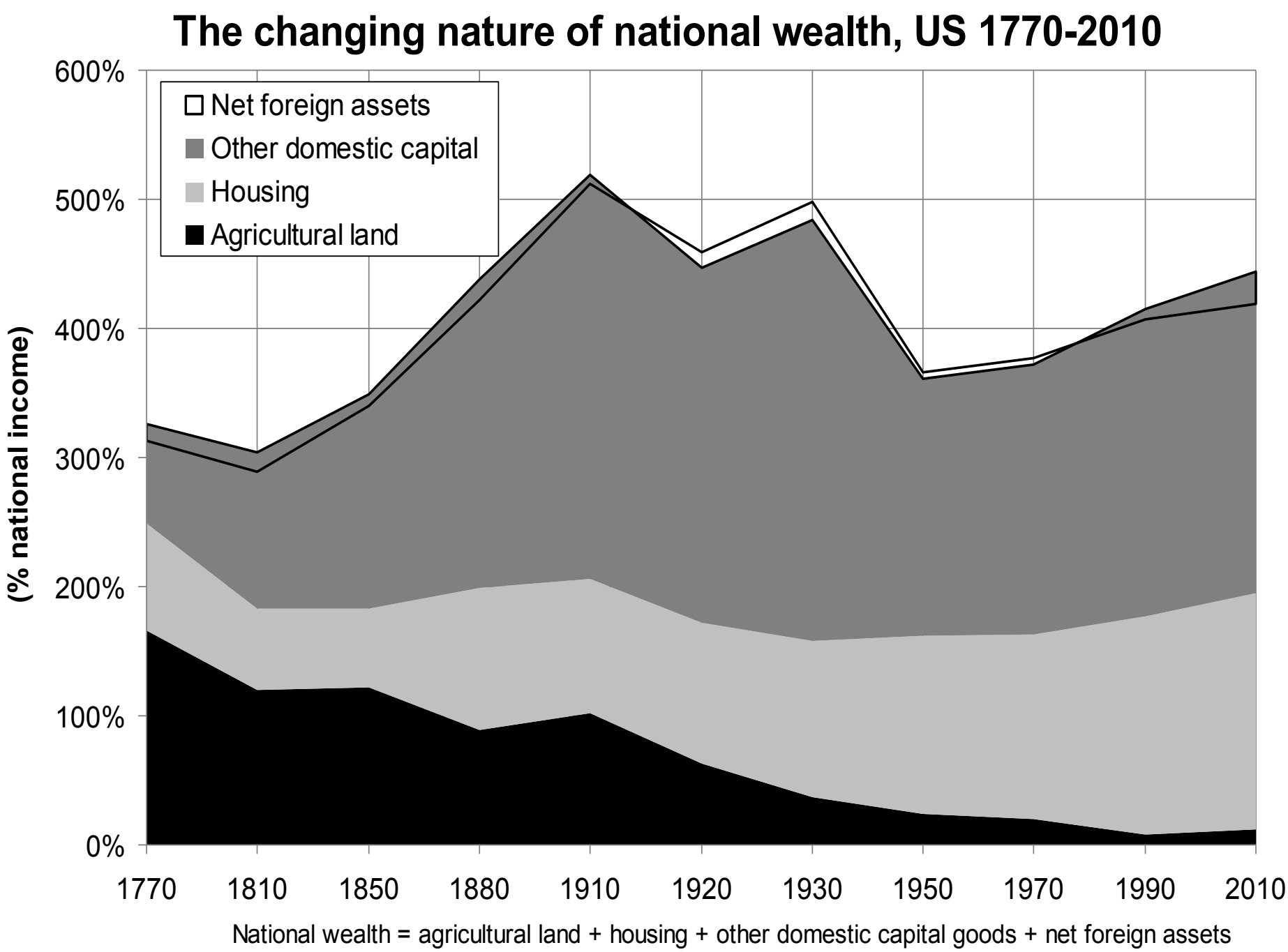
1700-2010: Data & Results

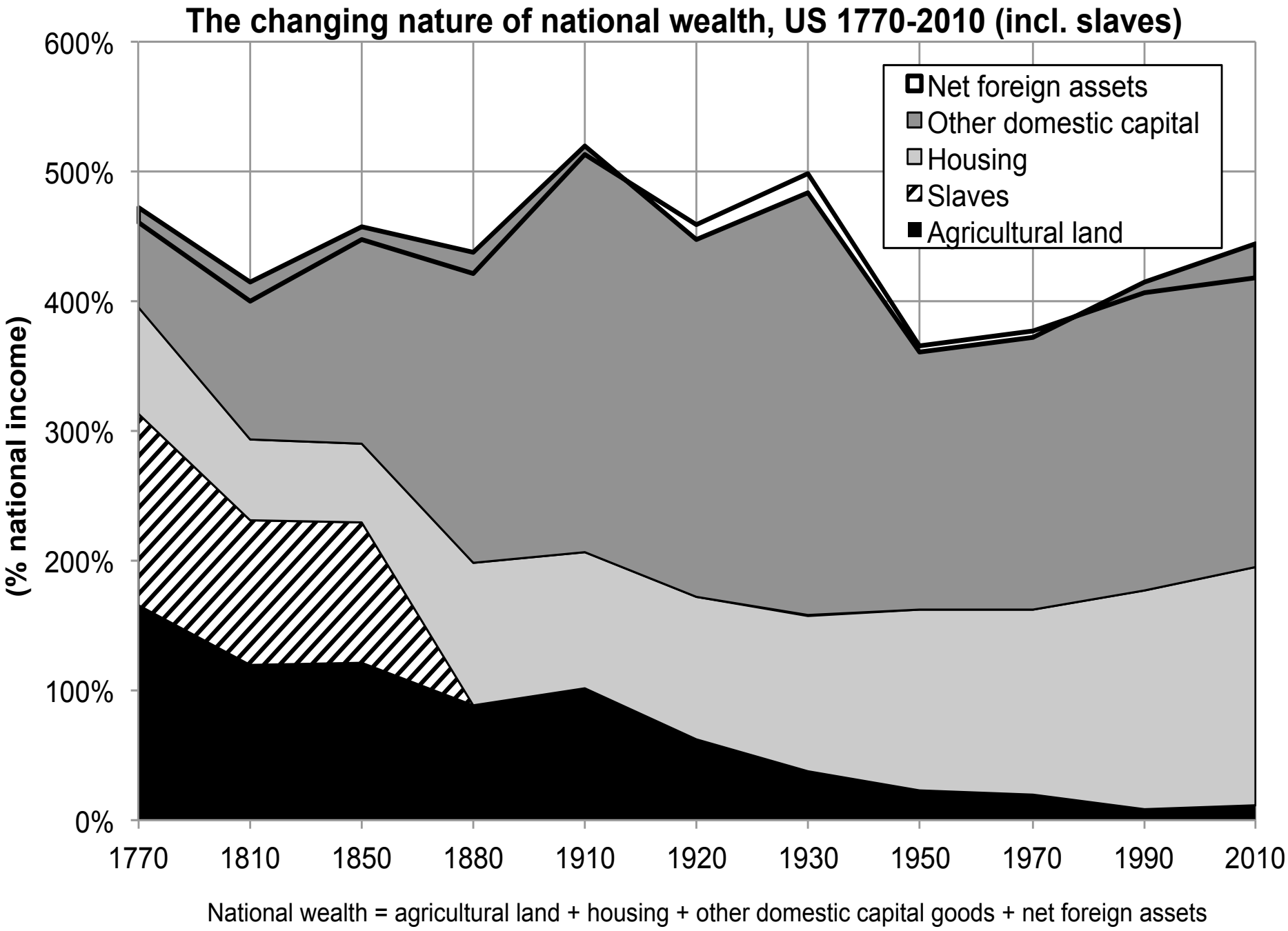
- **We use historical 18c balance sheets:**
  - UK, France: Petty (1664), King (1696), Vauban…
  - For US, available data start in 1770-1800
  - Saving series very approximate, so not possible to identify volume vs. price effects
  - But interesting to study changing nature of wealth and technology

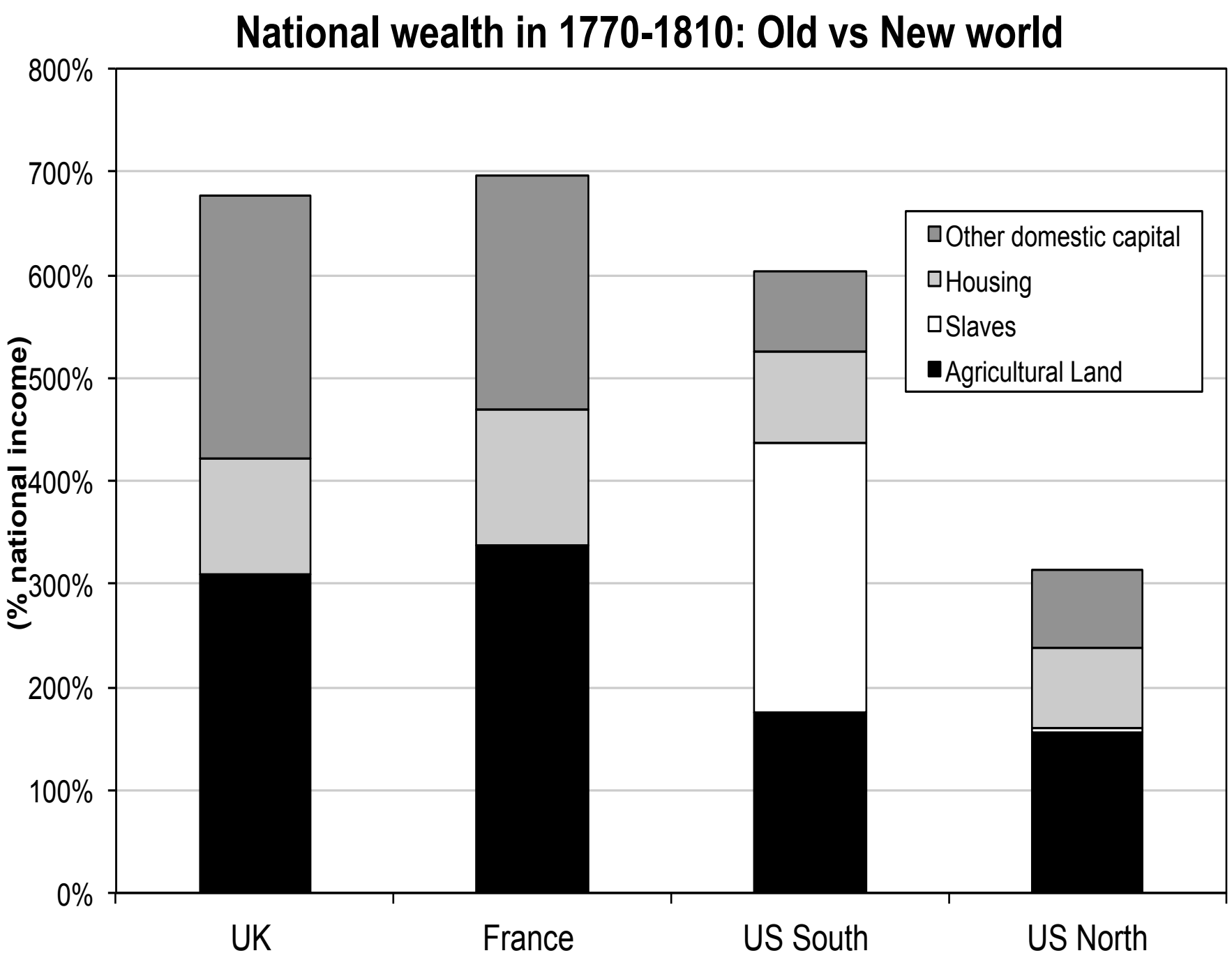
- **Main conclusions**:
  - β relatively stable around 600%-700% in UK & France
  - Despite huge changes in wealth composition: from agricultural land to manufacturing capital and housing

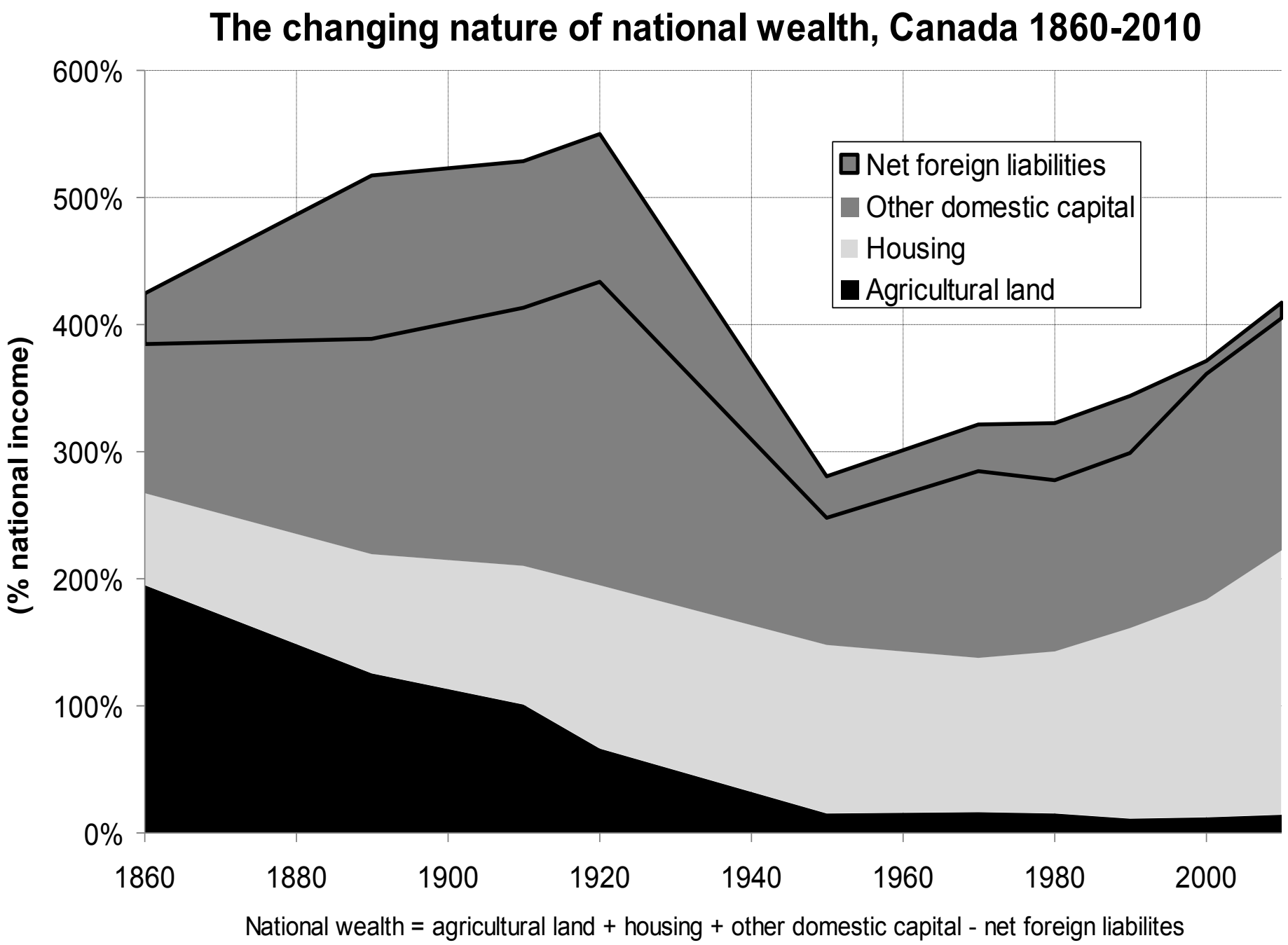

The changing nature of national wealth, UK 1700-2010
800%
700%
600%
500%
400%
300%
200%
100%
0%
(% national income)
Net foreign assets
Other domestic capital
Housing
Agricultural land
1700
1750
1810
1850
1880
1910
1920
1950
1970
1990
2010
National wealth = agricultural land + housing + other domestic capital goods + net foreign assets


The changing nature of national wealth, France 1700-2010
800%
700%
600%
500%
400%
300%
200%
100%
0%
(% national income)
Net foreign assets
Other domestic capital
Housing
Agricultural land
1700
1750
1780
1810
1850
1880
1910
1920
1950
1970
1990
2010
National wealth = agricultural land + housing + other domestic capital goods + net foreign assets


The changing nature of national wealth, US 1770-2010
600%
500%
400%
300%
200%
100%
0%
(% national income)
Net foreign assets
Other domestic capital
Housing
Agricultural land
1770
1810
1850
1880
1910
1920
1930
1950
1970
1990
2010
National wealth = agricultural land + housing + other domestic capital goods + net foreign assets


The changing nature of national wealth, US 1770-2010 (incl. slaves)
600%
500%
400%
300%
200%
100%
0%
(% national income)
1770
1810
1850
1880
1910
1920
1930
1950
1970
1990
2010
Net foreign assets
Other domestic capital
Housing
Slaves
Agricultural land
National wealth = agricultural land + housing + other domestic capital goods + net foreign assets


National wealth in 1770-1810: Old vs New world
800%
700%
600%
500%
400%
300%
200%
100%
0%
(% national income)
Other domestic capital
Housing
Slaves
Agricultural Land
UK
France
US South
US North


The changing nature of national wealth, Canada 1860-2010
600%
500%
400%
300%
200%
100%
0%
(% national income)
1860
1880
1900
1920
1940
1960
1980
2000
Net foreign liabilities
Other domestic capital
Housing
Agricultural land
National wealth = agricultural land + housing + other domestic capital - net foreign liabilites

In 18c Agrarian Societies, Key Force is Probably $\beta = \alpha/r$

- **How can we account for 18th century level of β?**
  - In agrarian, very low g societies, unclear which force dominates: $\beta = s/g$ or $\beta = \alpha/r$?
  - Probably $\beta = \alpha/r$
  - α = capital share = mostly land rents, determined by technology, politics, land availability ≈ 30-40% in Europe ≈ 10-15% in US
  - r = rate of time preference ≈ 4%-5%

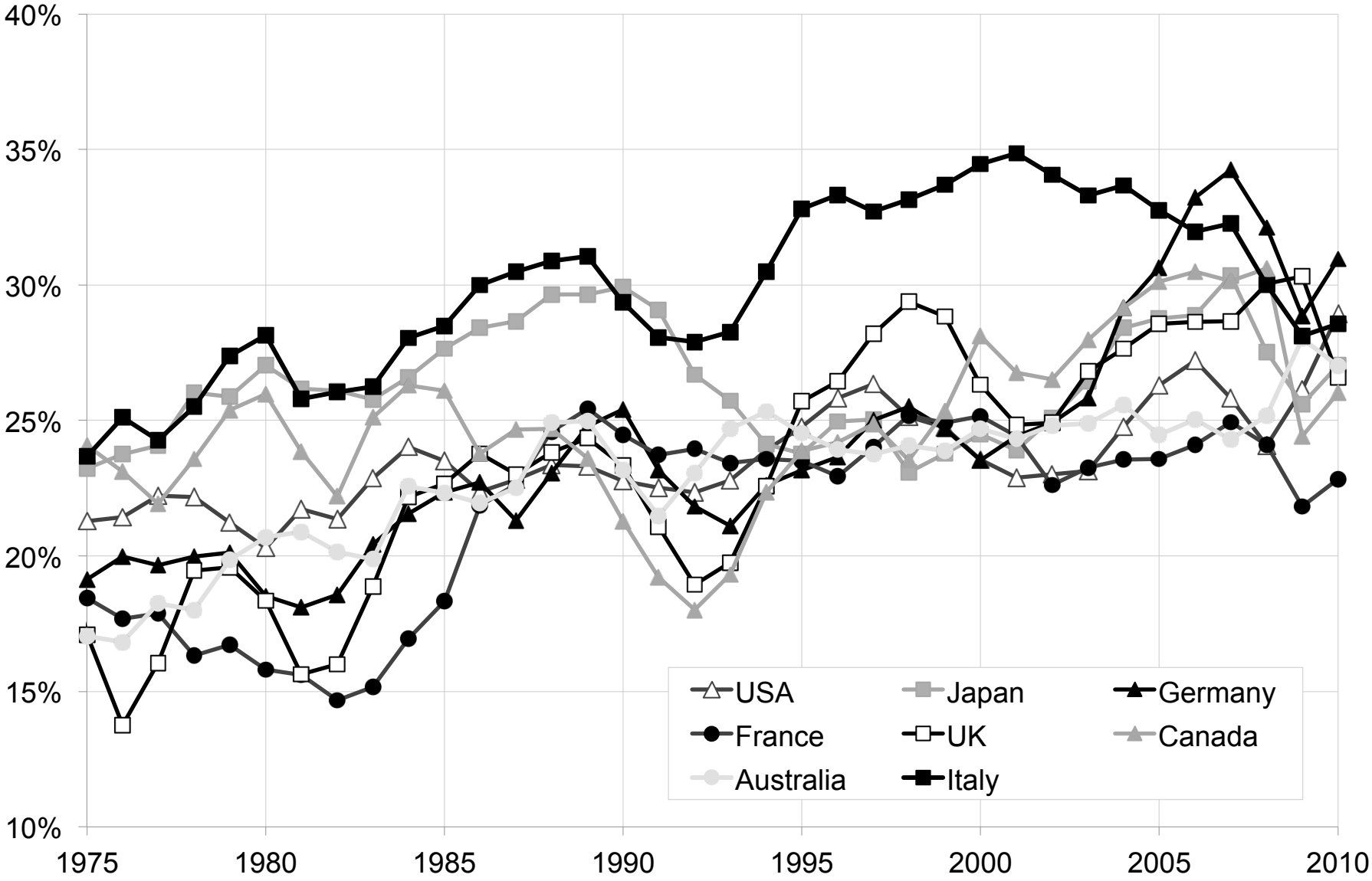
  → β = 600%-700% in Europe vs. 200%-300% in New World

⇩

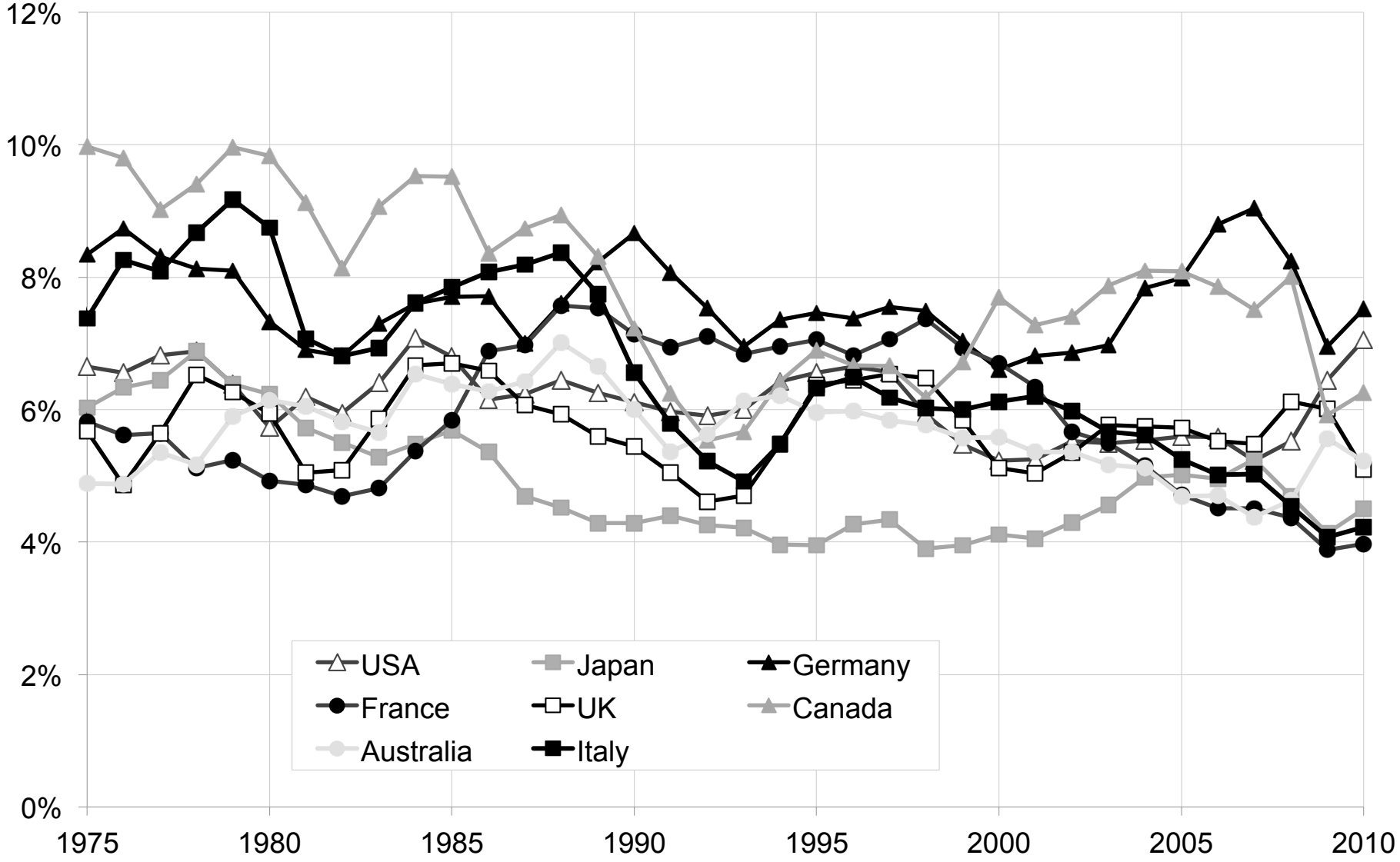
Nothing to do with $\beta = s/g$ mechanism, which bumped in later, with migration

5. Lessons for the Shape of the Production Function & Other Perspectives

Rising β Come With Rising Capital Shares α…



… And Slightly Declining Average Returns to Wealth → $\sigma > 1$ and Finite



In 18c Agrarian Societies: $\sigma < 1$

- **Wealth-income and capital shares in 18c:**
  - Capital is mostly land
  - Land-scarce Europe: $\beta \approx 600\text{-}700\%$ and $\alpha \approx 30\text{-}40\%$
  - Land-rich U.S. $\beta \approx 200\text{-}300\%$ and $\alpha \approx 10\text{-}15\%$

- **Cross-continent comparison suggests $\sigma < 1$:**
  - New world had more land in volume
  - But apparently lower β
  - Consistent with $\sigma < 1$: when low substitutability, price effect dominates volume effect: abundant land is worthless

Conclusion & Perspectives

- **Main conclusions:**
  - **Capital is back**: low β in 1950s-70s Europe were an anomaly
  - With low growth, long run β are naturally very large (600%-700%)
  - Key is $\beta = s/g$
  - There's nothing bad about the return of capital: K is useful, but it raises new issues about regulation & taxation
  - National accounts used to be about flows; need to focus on stocks

- **Next steps:**
  - **Plug distributions:** Will China or global billionaires own the world? Both divergence can occur, but 2nd more likely, esp. if $r > g$
  - **Normative implications:** relative importance of inherited vs. self-made wealth: 1910-2010 U-shaped pattern in France; on-going work on UK, Germany & US

Supplementary slides

- **Harrod-Domar-Solow formula $\beta = s/g$ is a pure accounting formula and is valid with any saving motive and utility function**

- **Wealth in the utility function**: Max $U(c_t, \Delta w_t = w_{t+1} - w_t)$

$\rightarrow$ if $U(c,\Delta) = c^{1-s} \Delta^s$, then fixed saving rate $s_t = s$

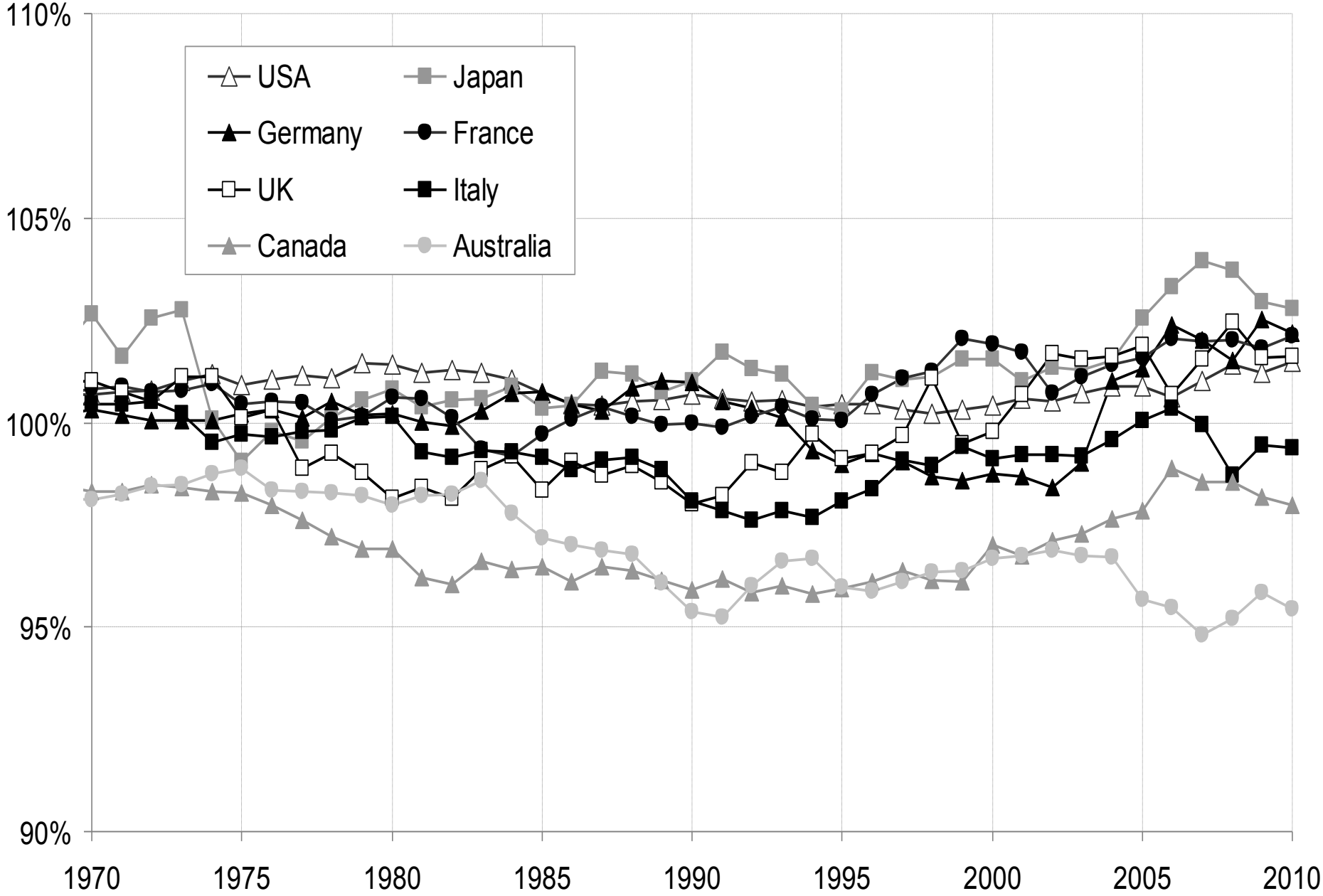
- **Dynastic utility**:

  Max $\Sigma\, U(c_t)/(1+\delta)^t$, with $U(c) = c^{1-1/\xi}/(1-1/\xi)$

$\rightarrow$ unique long rate rate of return $r_t \rightarrow r = \delta + \xi g > g$

$\rightarrow$ long run saving rate $s_t \rightarrow s = \alpha g/r$, $\beta_t \rightarrow \beta = \alpha/r = s/g$

National income / domestic product ratios, 1970-2010



Authors' computations using country national accounts. National income = domestic product + net foreign income

Table 3: Accumulation of private wealth in rich countries, 1970-2010 (additive decomposition)

	Private wealth-national income ratios		Decomposition of 2010 private wealth-national income ratio		
	β (1970)	β (2010)	Initial wealth effect	Cumulated new savings	Capital gains or losses
U.S.	342%	410%	113% 28%	236% 58% ***80%***	60% 15% ***20%***
Japan	299%	601%	110% 18%	456% 76% ***93%***	35% 6% ***7%***
Germany	225%	415%	104% 25%	356% 86% ***115%***	-45% -11% ***-15%***
France	310%	575%	130% 23%	346% 60% ***78%***	98% 17% ***22%***
U.K.	306%	522%	128% 25%	193% 37% ***49%***	201% 39% ***51%***
Italy	239%	676%	114% 17%	480% 71% ***85%***	83% 12% ***15%***
Canada	247%	416%	80% 19%	308% 74% ***92%***	28% 7% ***8%***
Australia	330%	518%	94% 18%	275% 53% ***65%***	149% 29% ***35%***

Table 6: Private savings 1970-2010: personal vs corporate

Average saving rates 1970-2010 (% national income)	Net private savings (personal + corporate)	incl. personal savings	incl. corporate savings (retained earnings)
U.S.	7.7%	4.6% ***60%***	3.1% ***40%***
Japan	14.6%	6.8% ***47%***	7.8% ***53%***
Germany	12.2%	9.4% ***76%***	2.9% ***24%***
France	11.1%	9.0% ***81%***	2.1% ***19%***
U.K.	7.3%	2.8% ***38%***	4.6% ***62%***
Italy	15.0%	14.6% ***97%***	0.4% ***3%***
Canada	12.1%	7.2% ***60%***	4.9% ***40%***
Australia	9.9%	5.9% ***60%***	3.9% ***40%***

Table 5: Private saving 1970-2010: gross vs net

Average saving rates 1970-2010 (% national income)	Gross private saving (personal + corporate)	Minus: Capital depreciation	Equal: Net private saving (personal + corporate)
U.S.	18.8%	11.1%	7.7%
Japan	33.4%	18.9%	14.6%
Germany	28.5%	16.2%	12.2%
France	22.0%	10.9%	11.1%
U.K.	19.7%	12.3%	7.3%
Italy	30.1%	15.1%	15.0%
Canada	24.5%	12.4%	12.1%
Australia	25.1%	15.2%	9.9%

Table 7: Accumulation of market-value national wealth in rich countries, 1970-2010 (additive decomposition)

	National wealth-national income ratios		Decomposition of 2010 market value national wealth-national income ratio		
	β (1970)	β (2010)	Initial wealth effect	Cumulated new savings	Capital gains or losses
U.S.	385%	419%	127% 30%	193% 46% ***66%***	98% 24% ***34%***
Japan	359%	616%	132% 21%	456% 74% ***94%***	27% 4% ***6%***
Germany	312%	418%	144% 34%	296% 71% ***108%***	-22% -5% ***-8%***
France	351%	605%	147% 24%	294% 49% ***64%***	164% 27% ***36%***
U.K.	365%	527%	153% 29%	140% 27% ***37%***	235% 44% ***63%***
Italy	259%	609%	123% 20%	273% 45% ***56%***	213% 35% ***44%***
Canada	284%	412%	92% 22%	257% 62% ***80%***	63% 15% ***20%***
Australia	391%	584%	111% 19%	253% 43% ***54%***	220% 38% ***46%***

Table 8: Accumulation of (market-value) national wealth in rich countries, 1970-2010 (multiplicative decomposition)

	National wealth-national income ratios		Decomposition of 1970-2010 wealth growth rate		
			Real growth rate of national wealth	Savings-induced wealth growth rate	Capital-gains-induced wealth growth rate
	β (1970)	β (2010)	g_w	$g_{ws} = s/\beta$	q
U.S.	385%	419%	3.0%	2.2% ***74%***	0.8% ***26%***
Japan	359%	616%	3.9%	3.1% ***78%***	0.8% ***22%***
Germany	312%	418%	2.7%	3.1% ***113%***	-0.4% ***-13%***
France	351%	605%	3.6%	2.7% ***75%***	0.9% ***25%***
U.K.	314%	523%	3.5%	1.5% ***42%***	2.0% ***58%***
Italy	259%	609%	4.1%	2.6% ***63%***	1.5% ***37%***
Canada	284%	412%	3.8%	3.4% ***89%***	0.4% ***11%***
Australia	391%	584%	4.2%	2.5% ***61%***	1.6% ***39%***

Table 11: Accumulation of government wealth in rich countries, 1970-2010 (additive decomposition)

	Government wealth-national income ratios		Decomposition of 2010 government wealth-national income ratio			
	β (1970)	β (2010)	Initial wealth effect	Cumulated new savings & other vol. changes	*incl. net interest payments*	Capital gains or losses
U.S.	43%	9%	14%	*-44%*	*-68%*	38%
Japan	61%	14%	22%	*0%*	*-38%*	-8%
Germany	87%	3%	40%	*-60%*	*-55%*	23%
France	41%	31%	17%	*-52%*	*-46%*	66%
U.K.	59%	6%	25%	*-53%*	*-58%*	34%
Italy	20%	-68%	9%	*-207%*	*-231%*	130%
Canada	37%	-4%	12%	*-51%*	*-75%*	34%
Australia	61%	67%	17%	*-21%*	*-23%*	70%

Table 13: Foreign saving 1970-2010: trade vs investment balance

Average saving rates 1970-2010 (% national income)	Net foreign saving	incl. net exports & transfers	incl. net foreign investment income
U.S.	-2.8%	-3.6%	0.7%
Japan	2.8%	1.4%	1.4%
Germany	2.0%	1.7%	0.2%
France	-0.3%	-1.1%	0.8%
U.K.	-1.5%	-1.6%	0.1%
Italy	-0.3%	0.5%	-0.8%
Canada	-0.1%	2.9%	-3.0%
Australia	-4.7%	-1.3%	-3.5%

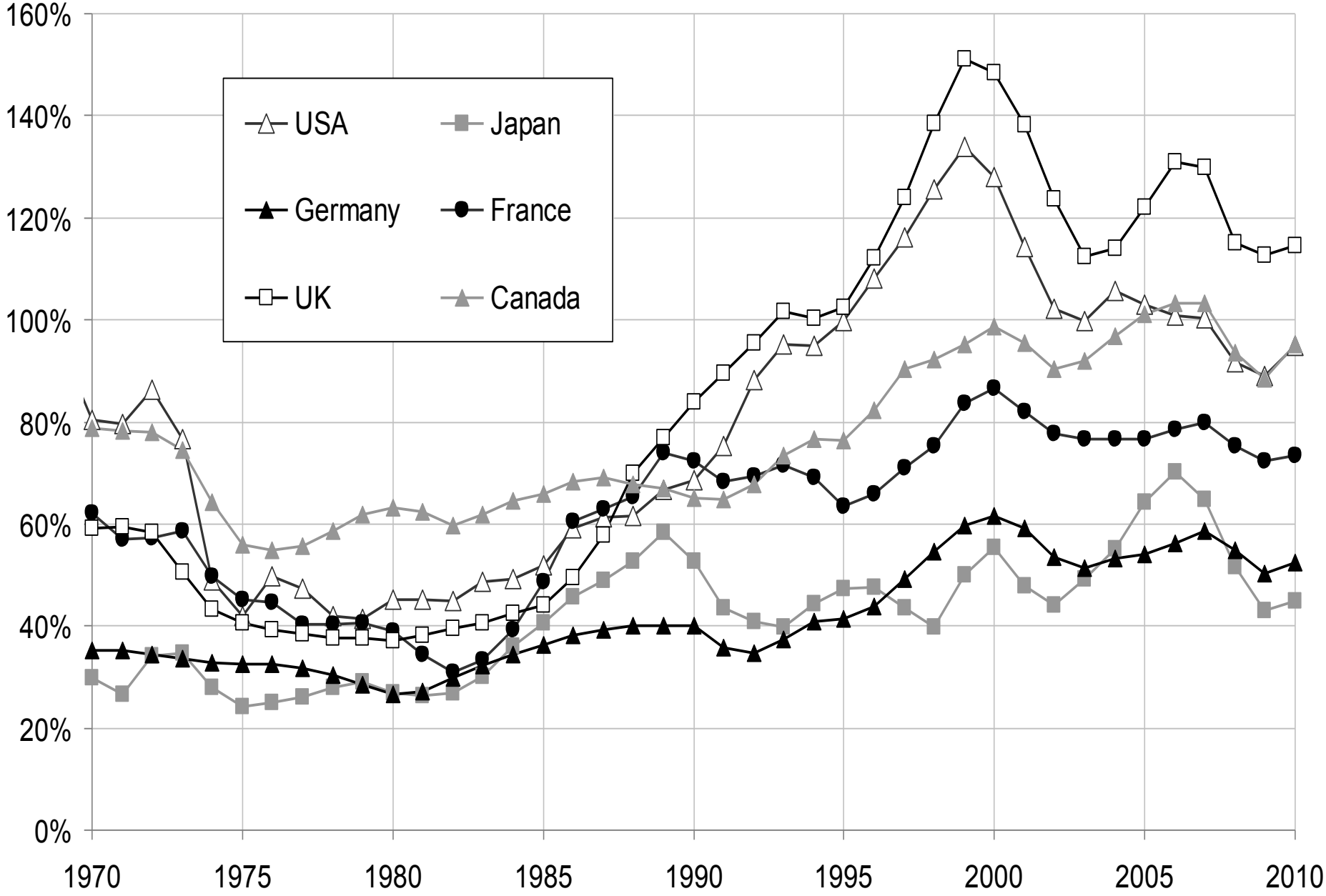
Table 14: Accumulation of foreign wealth in rich countries, 1970-2010 (additive decomposition)

	Foreign wealth-national income ratios		Decomposition of 2010 foreign wealth-national income ratio				
	β (1970)	β (2010)	Initial wealth effect	Cumulated saving & other volume changes	*incl. net exports & transfers*	*incl. net investment income*	Capital gains or losses
U.S.	4%	-25%	1%	-60%	*-90%*	*19%*	33%
Japan	3%	67%	1%	84%	*43%*	*41%*	-18%
Germany	8%	42%	4%	57%	*51%*	*6%*	-19%
France	11%	-13%	5%	-2%	*-33%*	*23%*	-15%
U.K.	6%	-20%	3%	-41%	*-42%*	*2%*	18%
Italy	12%	-31%	5%	-9%	*17%*	*-26%*	-27%
Canada	-41%	-10%	-13%	-4%	*74%*	*-77%*	7%
Australia	-20%	-70%	-6%	-106%	*-28%*	*-78%*	41%

Table 15: Accumulation of national wealth in rich countries: domestic vs. foreign capital gains

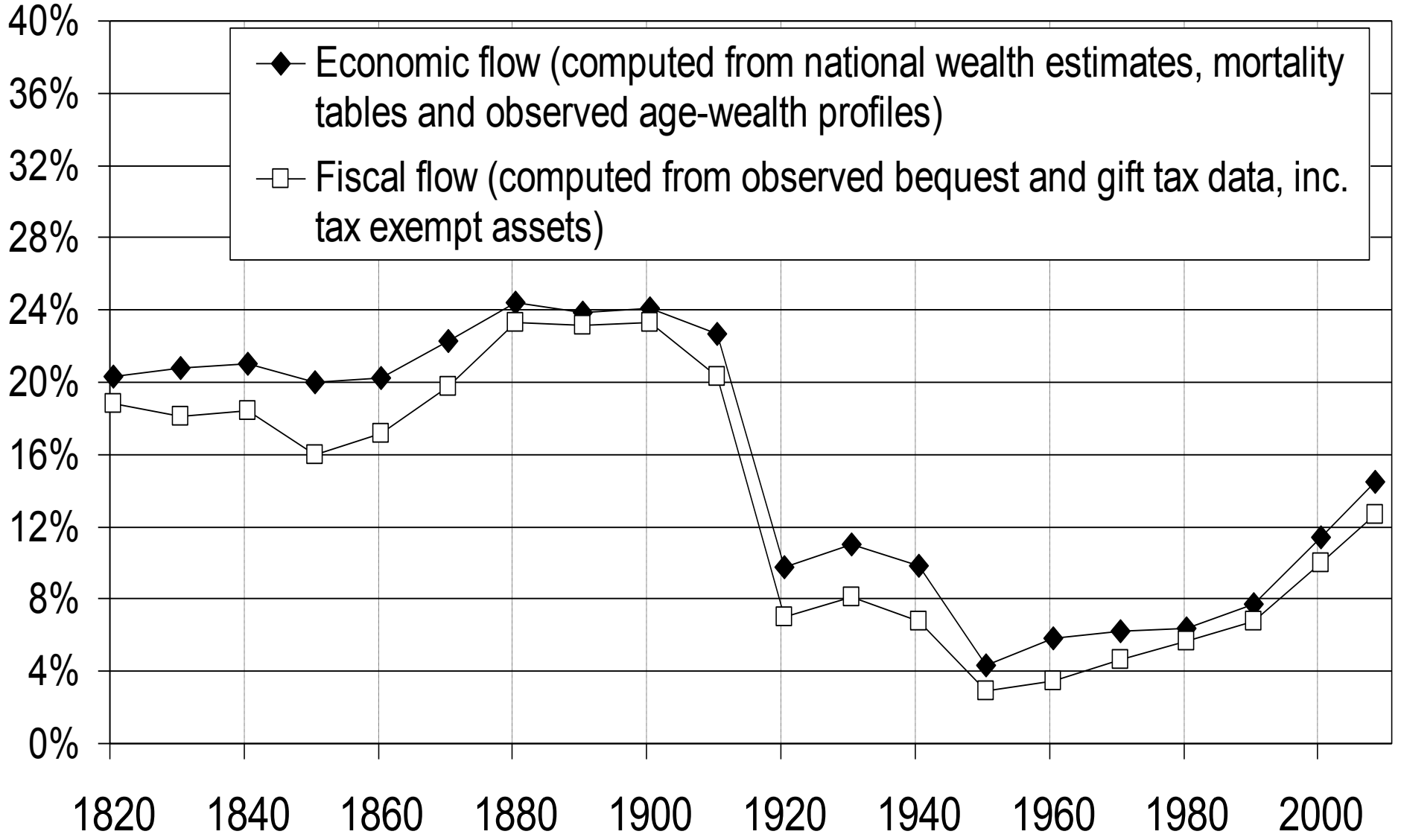
	1970-2010 capital gains on national wealth (% of national income)	Decomposition of 1970-2010 capital gains	
		Domestic wealth	Foreign wealth
U.S.	98%	66% 67%	33% 33%
Japan	27%	45% 164%	-18% -64%
Germany	-22%	-3% 14%	-19% 86%
France	164%	179% 109%	-15% -9%
U.K.	235%	217% 92%	18% 8%
Italy	213%	240% 113%	-27% -13%
Canada	63%	55% 88%	7% 12%
Australia	220%	178% 81%	41% 19%

Corporate market value / book value Q-ratios 1970-2010



Authors' computations using country national accounts. Q ratio = market value/book value = equity/(assets - debt) (corporate sector)

Annual inheritance flow as a fraction of national income, France 1820-2008



Source: T. Piketty, "On the long-run evolution of inheritance", QJE 2011