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

Thomas Piketty (PSE)
Gabriel Zucman (LSE and UC Berkeley)

December 2013

How do wealth-income and capital-output ratios evolve in the long-run and why?

- Impossible to address this question until recently: national accounts mostly about flows, not stocks
- We have compiled a new database of national balance sheets to address it

Table 1: A new macro database on income and wealth

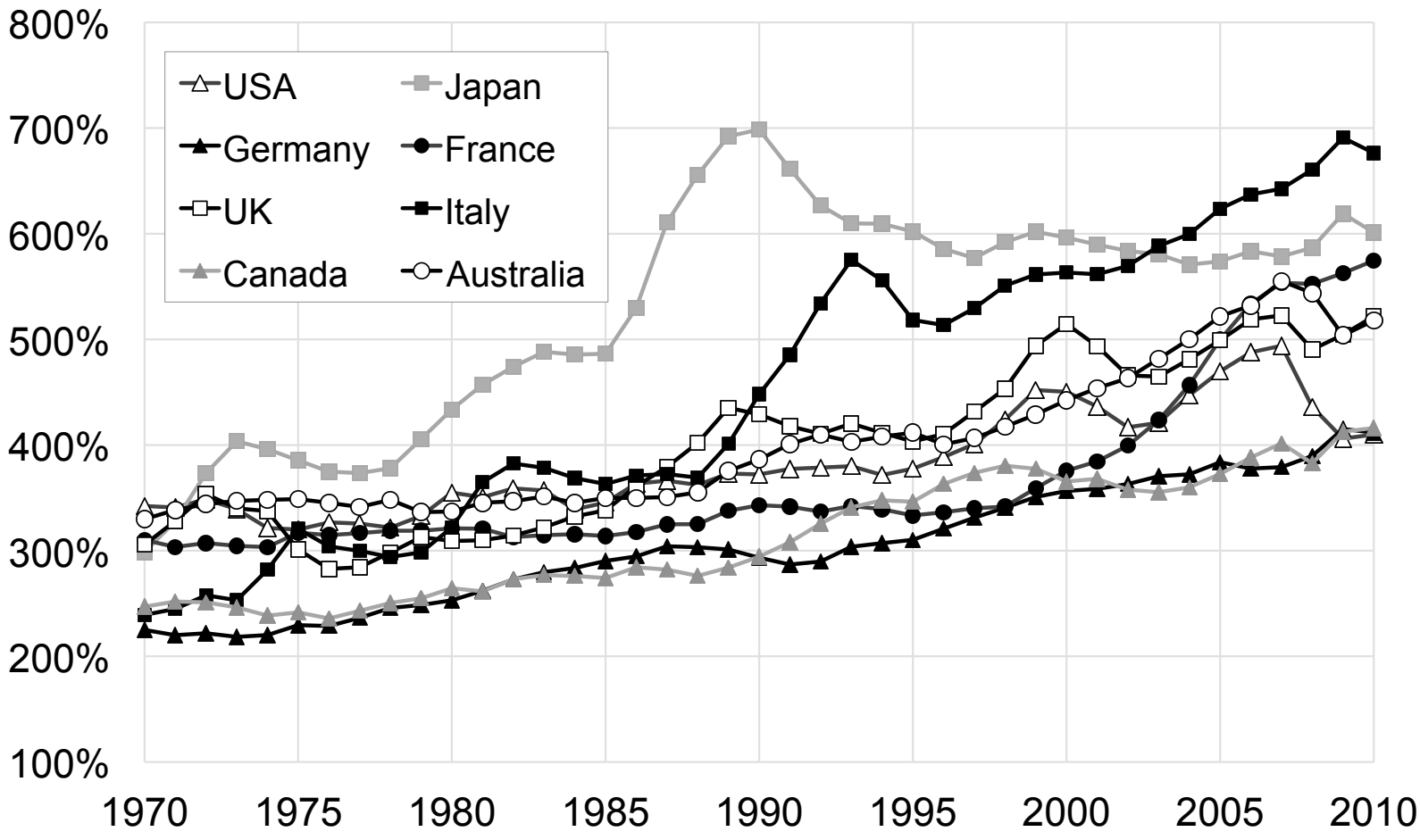
	Total period covered in database	Annual series	Decennial estimates
U.S.	**1770-2010**	1869-2010	1770-2010
Japan	**1960-2010**	1960-2010	
Germany	**1870-2010**	1870-2010	
France	**1700-2010**	1896-2010	1700-2010
U.K.	**1700-2010**	1855-2010	1700-2010
Italy	**1965-2010**	1965-2010	
Canada	**1970-2010**	1970-2010	
Australia	**1970-2010**	1970-2010	

The wealth and income concepts we use

- Private wealth W = assets - liabilities of households (corporations valued at market prices through equities)
- Government wealth W_g
- Market-value national wealth $W_n = W + W_g$
- $W_n = K$ (land+housing+other domestic K) $+NFA$
- Domestic output $Y_d = F(K, L)$ (net of depreciation)
- National income $Y = Y_d + rNFA$
- Private wealth-national income ratio $\beta = W/Y$
- National wealth-national income ratio $\beta_n = W_n/Y$
- Capital-output ratio $\beta_k = K/Y_d$

We find a gradual rise of private wealth-national income ratios since 1970

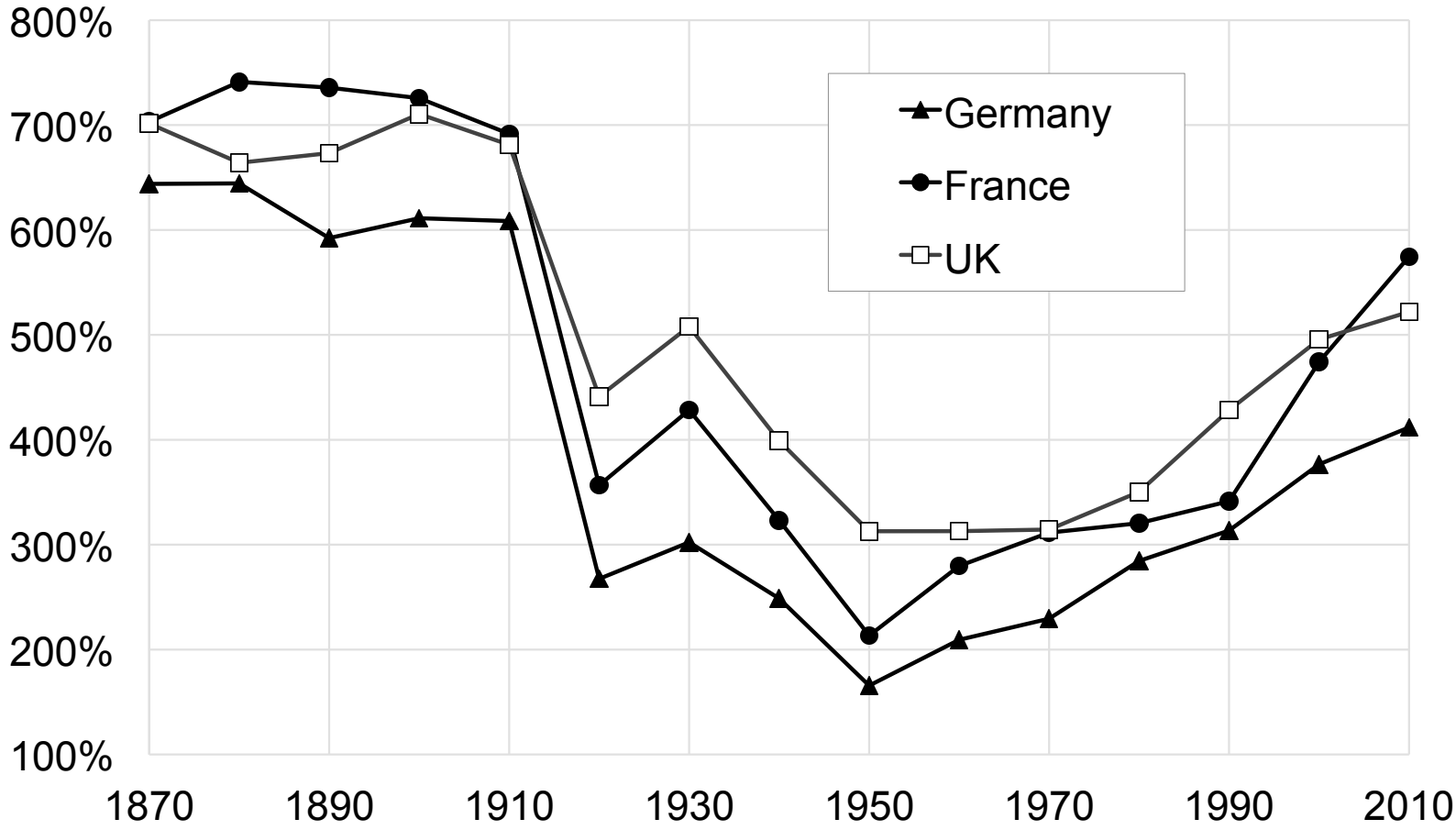
Figure 1: Private wealth / national income ratios 1970-2010



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

European ratios appear to be returning to their high 18c-19c values...

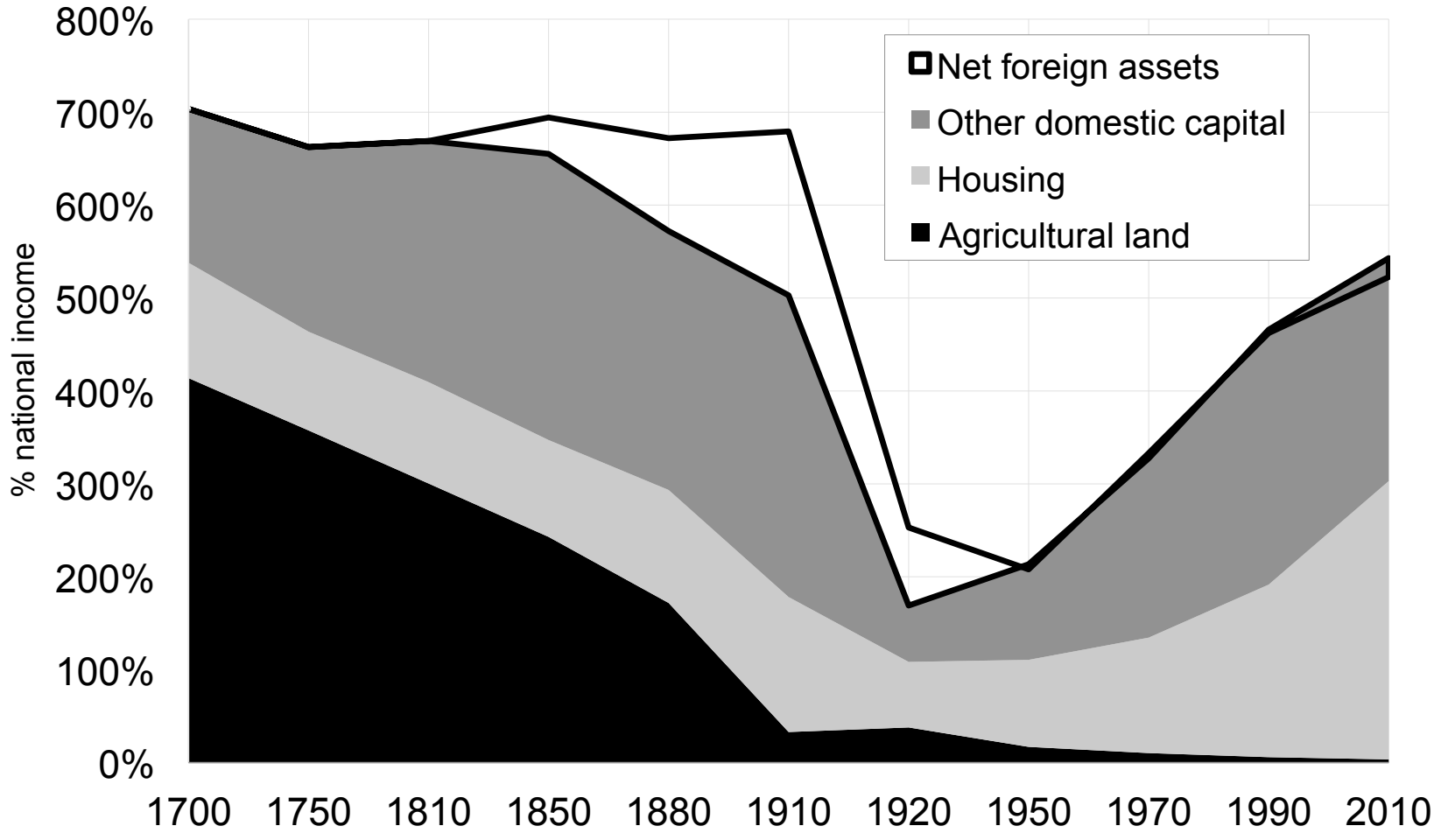
Figure 2: Private wealth / national income ratios in Europe 1870-2010



Authors' computations using country national accounts. Private wealth = non-financial assets + financial assets - financial liabilities (household & non-profit sectors). Data are decennial averages (1910-1913 averages for 1910)

Despite huge changes in the nature of wealth

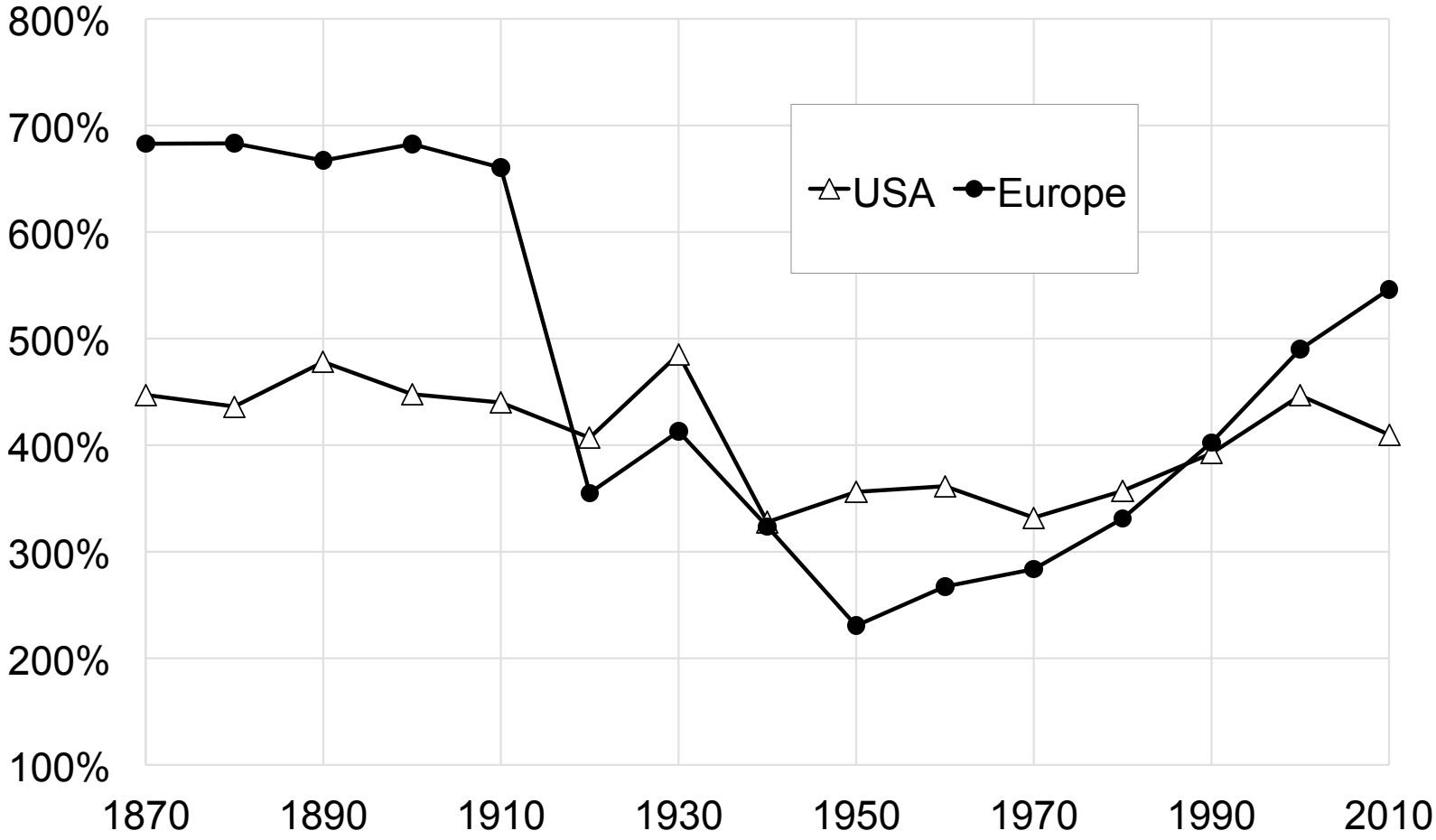
Figure 3: The changing nature of national wealth: UK 1700-2010



National wealth = agricultural land + housing + other domestic capital goods + net foreign assets

US evolution is also U-shaped but less so

Figure 4: Private wealth / national income ratios 1870-2010: Europe vs. USA



Authors' computations using country national accounts. Private wealth = non-financial assets + financial assets - financial liabilities (household & non-profit sectors). Data are decennial averages (1910-1913 averages for Europe)

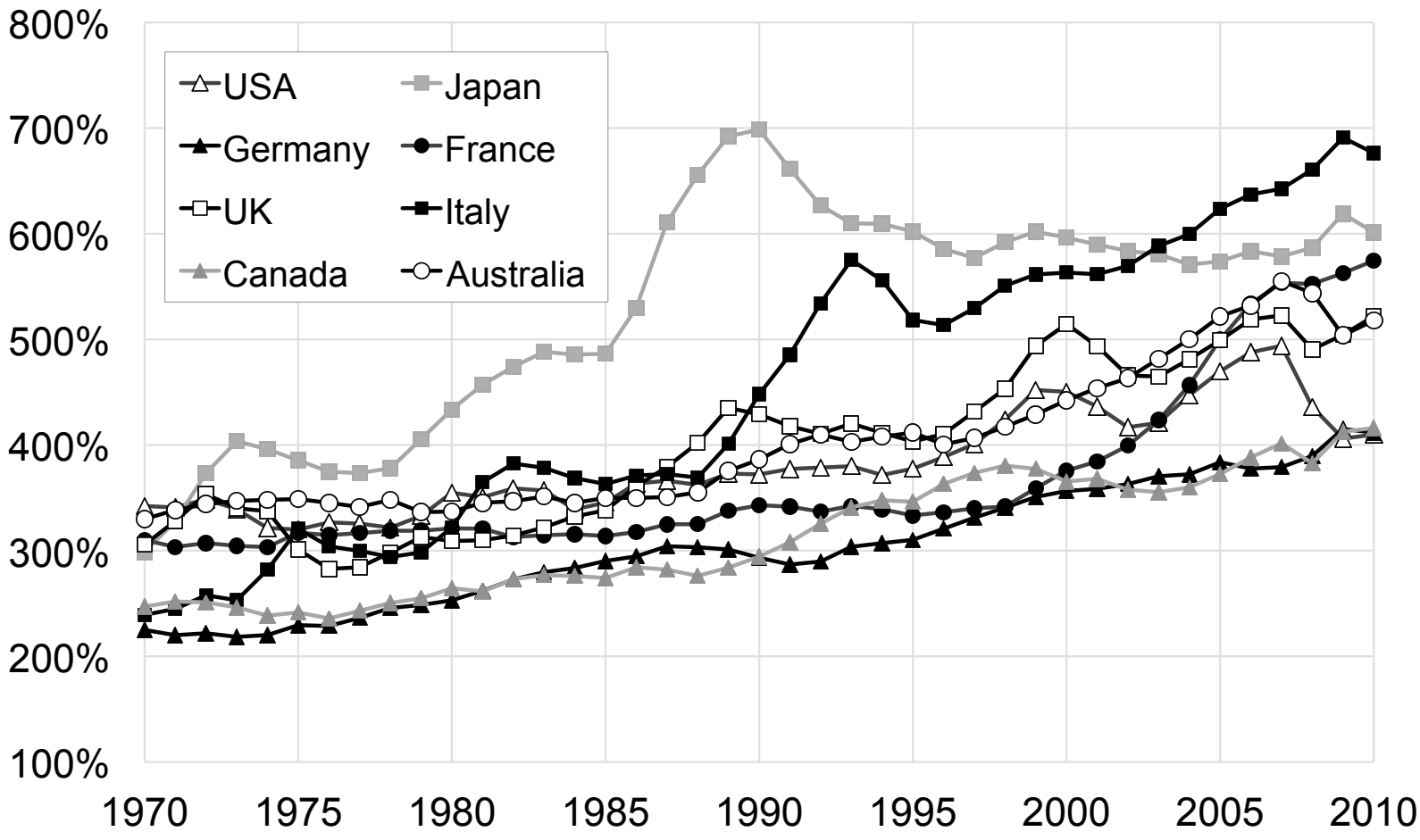
Outline of the talk

1. The 1970-2010 rise of wealth-income ratios
2. The 1870-2010 U-shaped evolution of wealth-income ratios
3. The changing nature of wealth 1700-2010
4. Implications of the return of high wealth-income ratios

I- The 1970-2010 rise of wealth-income ratios

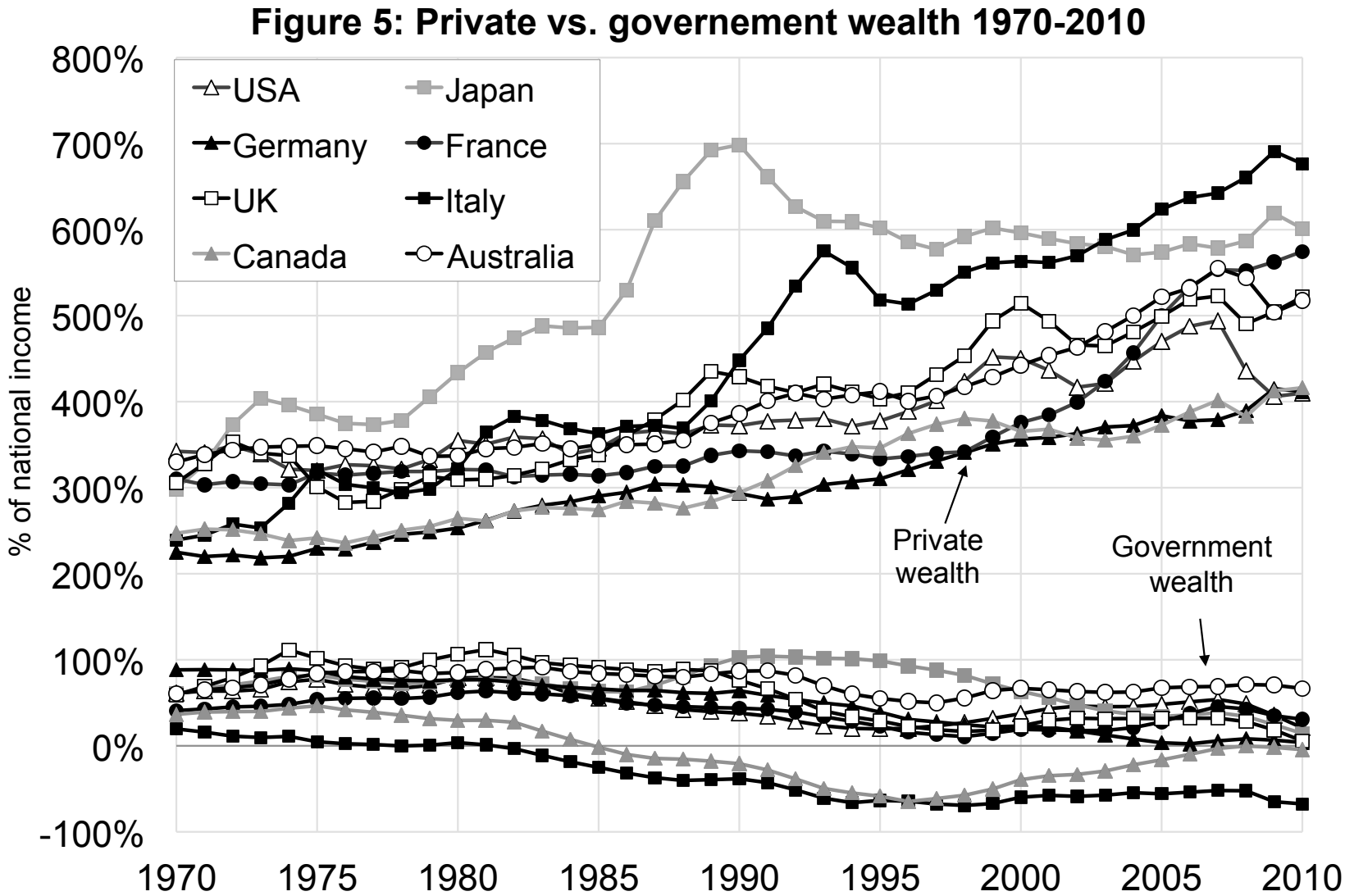
1970-2010: general rise of private wealth, with interesting cross-country variations

Figure 1: Private wealth / national income ratios 1970-2010



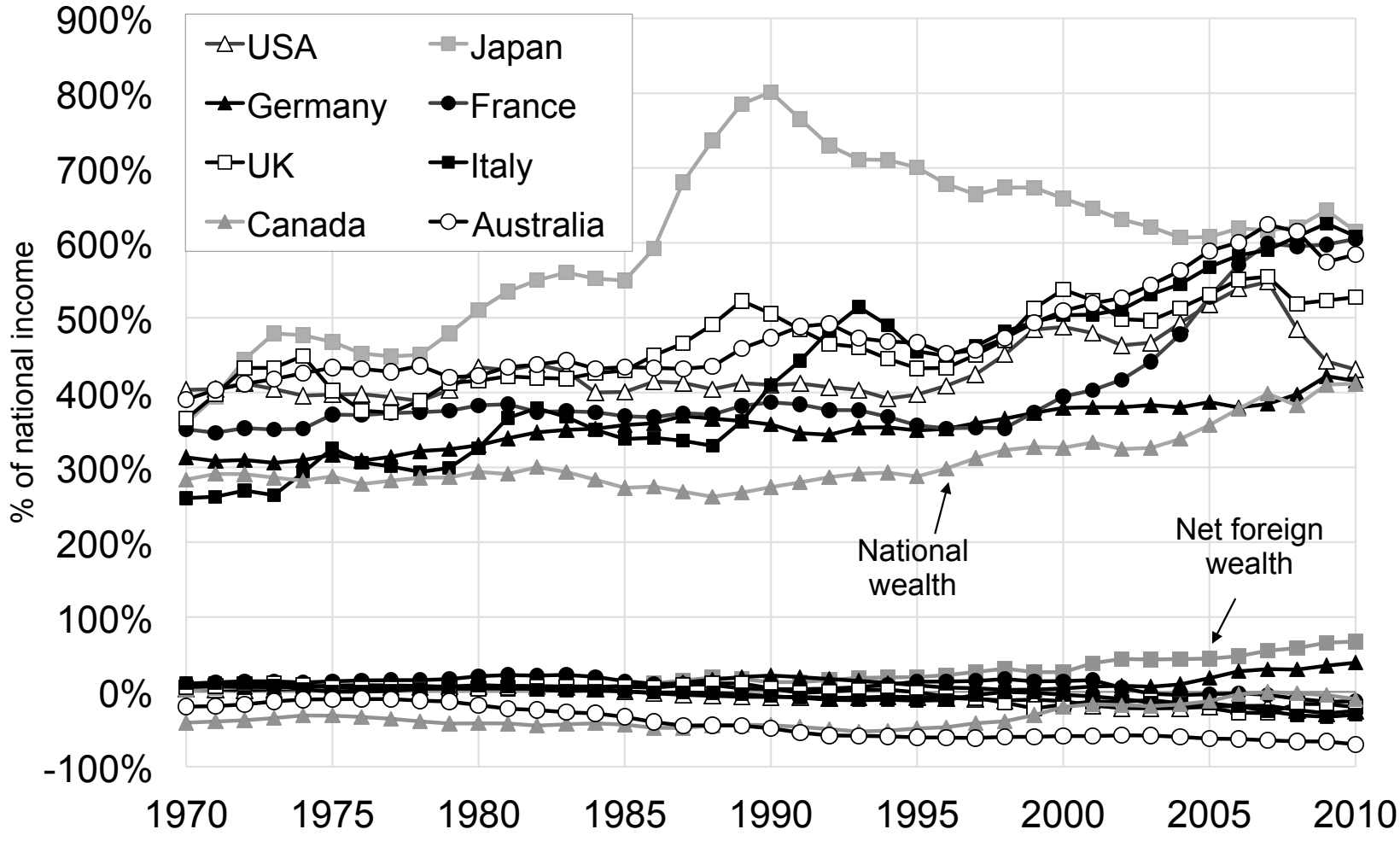
Authors' computations using country national accounts. Private wealth = non-financial assets + financial assets - financial liabilities (household & non-profit sectors)

Rise of private wealth has been larger than decline of government wealth...



...So that national wealth has also increased

Figure 6: National vs. foreign wealth, 1970-2010



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

How can we explain 1970-2010 rise of β?

Two key factors:

1. **Slowdown of productivity and pop. growth**, in line with Harrod-Domar-Solow formula $\beta = s/g$:
   - In the long-run, wealth-income ratio $\beta = s/g$
   - If $s = 10\%$ and $g = 3\%$ then $\beta \approx 300\%$
   - But if $s = 10\%$ and $g = 1.5\%$ then $\beta \approx 600\%$
   - g = productivity + pop. growth
2. A **rise in relative asset prices**, itself driven by changes in capital policies since world wars

Factor 1: Growth slowdown

A quick refresher on the Harrod-Domar-Solow formula:

- $W_{t+1} = W_t + s_t Y_t$
- $\beta_{t+1} = \beta_t(1 + g_{wst})/(1 + g_t)$
  - $1 + g_{wst} = 1 + s_t/\beta_t =$ 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 $g_t = g$:
  $\beta_t \to \beta = s/g$ **(Harrod-Domar-Solow formula)**
- True in the steady-state of any one-good model of capital accumulation
- True wherever s comes from

$\beta \to s/g$ is true wherever s comes from

Production: $Y_{dt} = F(K_t, L_t)$ with $L_t = L_0 e^{gt}$. Utility:

- **If wealth or bequest in the utility function** $V(c, b) = c^{1-s} b^s$ then saving rate is set by taste for wealth s (and demography if life-cycle saving)
- **If dynastic utility** $V = \int e^{-\theta t} c_t^{1-\gamma}/(1-\gamma)$ then $r = \theta + \gamma g$ and $\beta = \alpha/r = \alpha/(\theta + \gamma g) \nearrow$ as $g \searrow$

$$\Downarrow$$

In all cases, $\beta = s/g$ increases as $g \searrow$

Factor 1: Growth slowdown (continued)

$\beta = s/g$ helps understand some key features of the data:

- Large fraction of rise in β in low-growth countries (Japan, Europe)
- Europe vs. US difference

With low growth, β may become very high in the whole world

- But no reason why β should reach any specific value
- All values possible in steady-state because s and g vary for all sorts of reasons

Because s and g vary for many independent reasons, β can vary a lot across countries

Table 2: Growth rate vs private saving rate 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%**	0.6%	1.6%	**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%**

Authors' computations using country national accounts. Growth rates are geometric averages and for income use chain-weighted GDP deflators. For alternative deflators, see Appendix Table A3 and Country Tables US.3, JP.3, etc. 1970-2010 average saving rates are obtained by weighting yearly saving rates by real national income.

Factor 2: The role of asset prices

Consider now a two-goods model (one capital and 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

Is the rise of β mostly due to saving or capital gains?

Our strategy to identify the source of the rise of β:

- We decompose the evolution of β into 2 multiplicative components:

$$\beta_{t+1} = \frac{(1 + g_{wst})(1 + q_t)}{1 + g_t}\beta_t$$

- We do not specify where q_t comes from and infer it from the data at our disposal on $\beta_t ... \beta_{t+n}$, $s_t ... s_{t+n}$ and $g_t ... g_{t+n}$

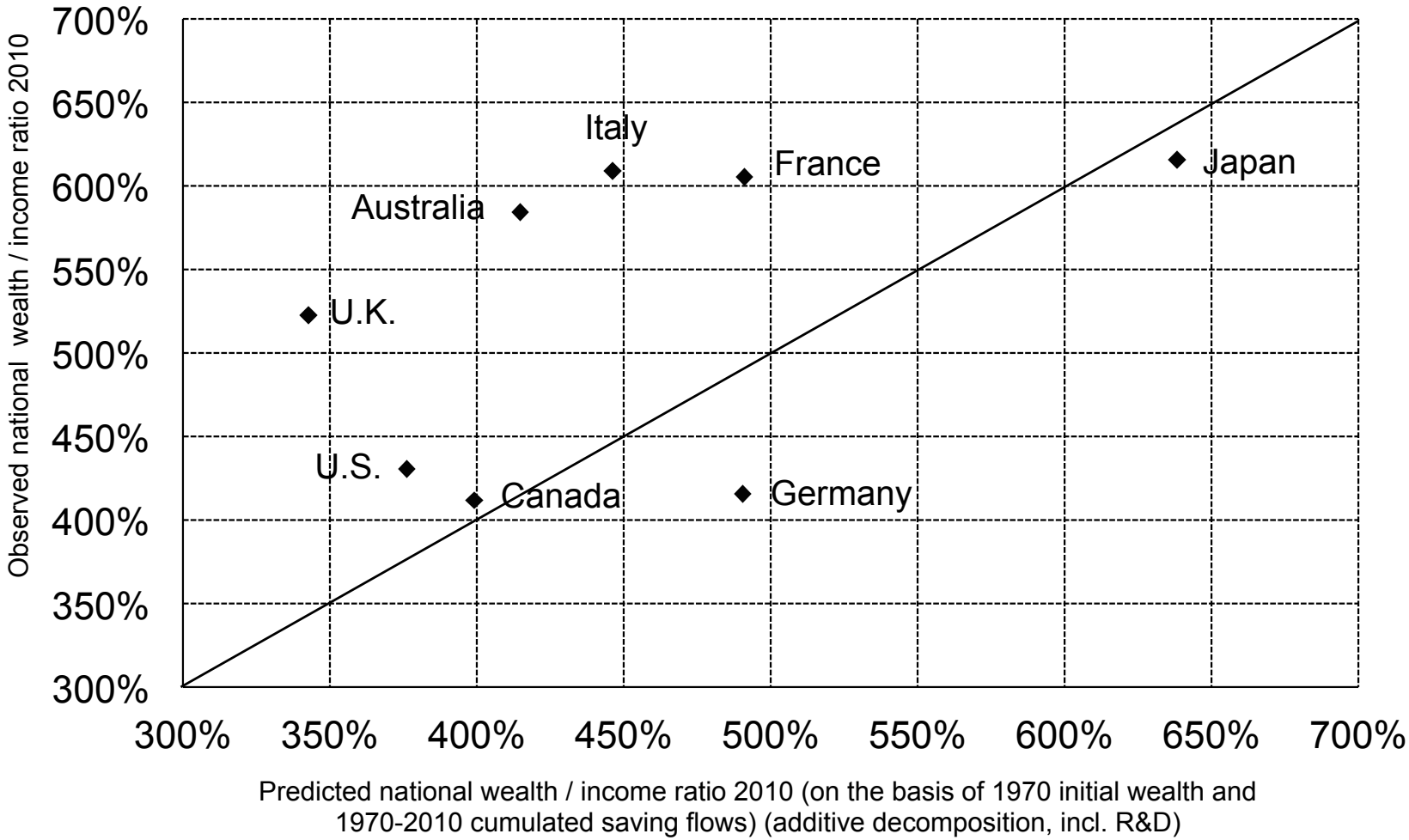
We find a clear pattern of positive K gains

Table 4: Accumulation of national wealth in rich countries, 1970-2010

	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.	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%***

Rising asset prices played an important role in Europe, except in Germany

Figure 7a: Observed vs. predicted national wealth / national income ratios (2010)



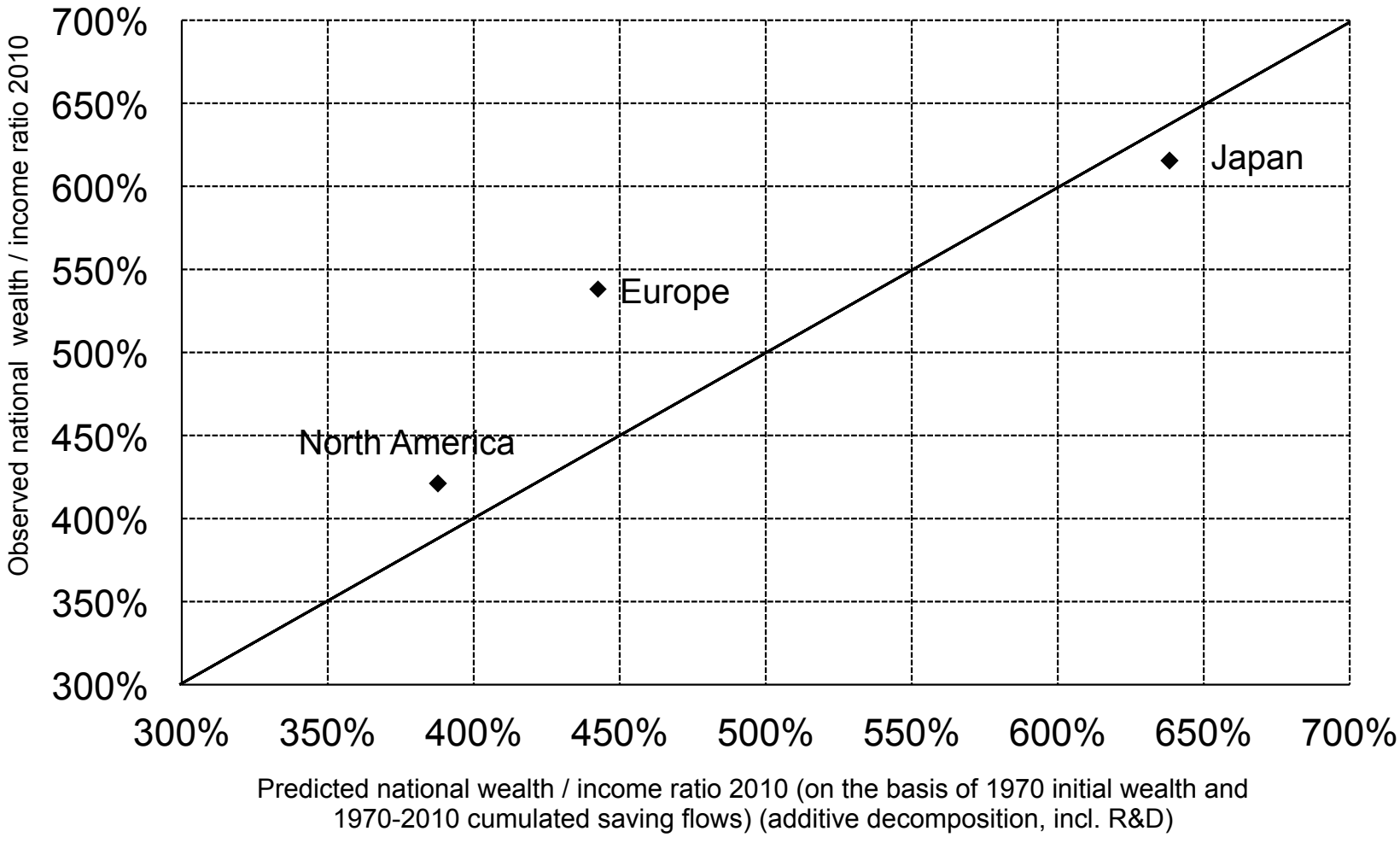
The two sources of capital gains: domestic (Europe) vs. foreign (U.S.)

Table 6: National wealth accumulation in rich countries: domestic vs. foreign capital gains

	1970-2010 capital gains on national wealth (% of 2010 national income)	Decomposition of 1970-2010 capital gains	
		Domestic wealth	Foreign wealth
U.S.	105%	72%	33%
Japan	27%	45%	-18%
Germany	-25%	-3%	-22%
France	164%	179%	-15%
U.K.	235%	217%	18%
Italy	213%	240%	-27%
Canada	63%	55%	7%
Australia	220%	178%	41%

At a very aggregated level, key force is s/g

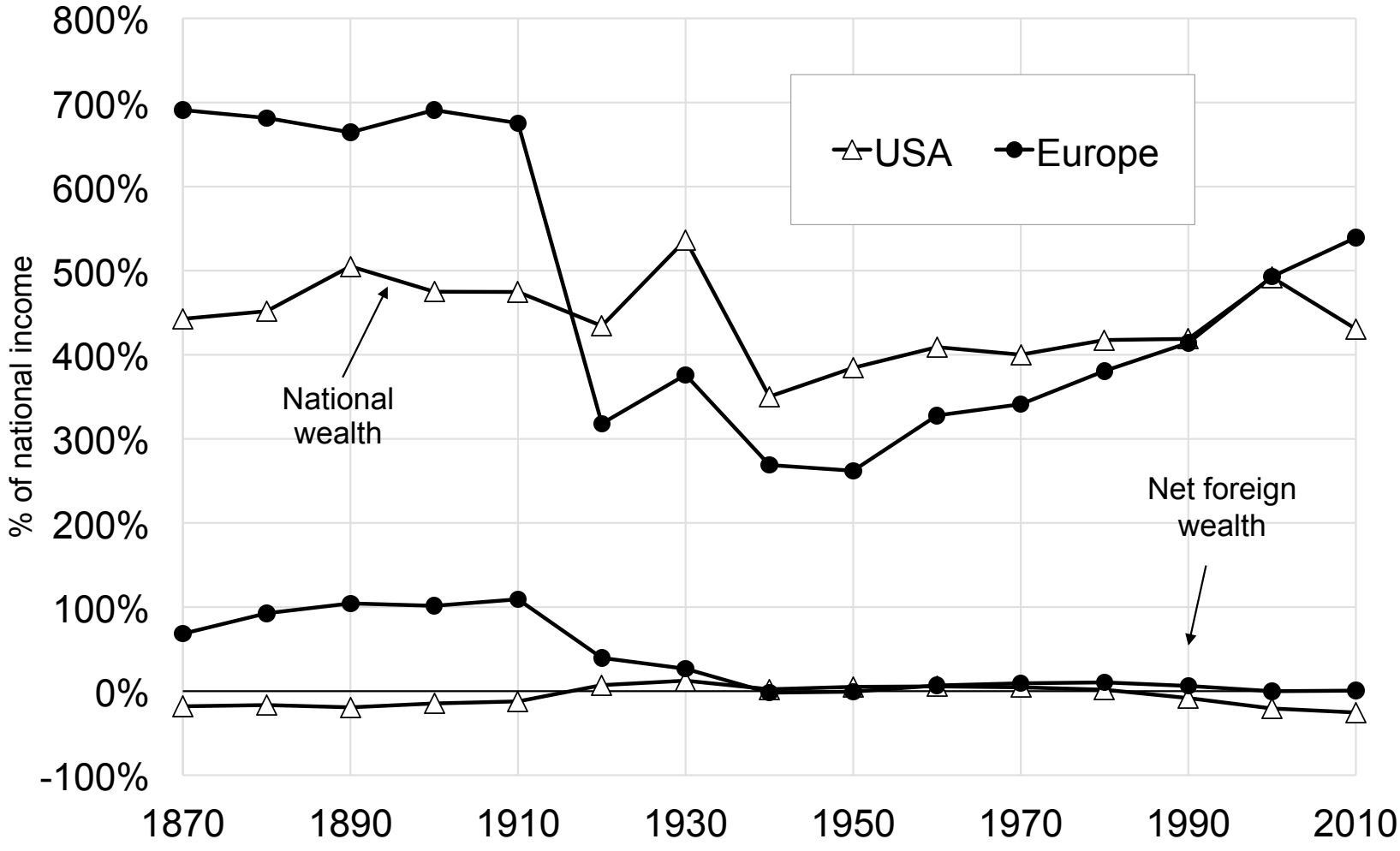
Figure 7b: Observed vs. predicted national wealth / national income ratios (2010)



II- The 1870-2010 U-shaped evolution of wealth-income ratios

How can we explain 1870-2010 evolution?

Figure 8: National and foreign wealth 1870-2010: Europe vs. USA



Asset prices decreased a lot in the interwar, and then recovered

Table 9: Accumulation of national wealth: US, UK, Germany, France, 1870-2010

	Market-value national wealth-national income ratios		Real growth rate of national wealth	Savings-induced wealth growth rate (incl. war destructions)	Capital-gains-induced wealth growth rate
	β_t	β_{t+n}	g_w	$g_{ws} = s/\beta$	q
	Panel D: France				
1870-2010	689%	605%	2.0%	1.8% ***91%***	0.2% ***9%***
1870-1910	689%	747%	1.3%	1.4% ***103%***	0.0% ***-3%***
1910-2010	747%	605%	2.2%	2.0% ***89%***	0.3% ***11%***
1910-1950	747%	261%	-1.2%	-0.1% ***8%***	-1.1% ***92%***
1950-1980	261%	383%	5.9%	4.7% **80%**	1.2% **20%**
1980-2010	383%	605%	3.4%	2.2% ***65%***	1.2% ***35%***

In the very long run, seems like no big relative price divergence

Table 8: Accumulation of national wealth in rich countries, 1870-2010

	Market-value national wealth-national income ratios		Real growth rate of national income	Decomposition of 1870-2010 wealth growth rate		
				Real growth rate of wealth	Savings-induced wealth growth rate	Capital-gains-induced wealth growth rate
	β (1870)	β (2010)	g	g_w	$g_{ws} = s/\beta$	q
U.S.	413%	431%	3.4%	3.4%	2.6% ***76%***	0.8% ***24%***
Germany	745%	416%	2.3%	2.0%	2.6% ***128%***	-0.6% ***-28%***
France	689%	605%	2.1%	2.0%	1.8% ***91%***	0.2% ***9%***
U.K.	656%	523%	1.9%	1.8%	1.6% ***89%***	0.2% ***11%***

The real growth rate of national wealth has been 3.4% per year in the U.S. between 1870 and 2010. This can be decomposed into a 2.6% savings-induced growth rate and a 0.8% residual term (capital gains and/or measurement errors).

Authors' computations using country national accounts. War destructions & other volume changes were included in savings-induced wealth growth rate. For full decomposition, see Appendix Country Tables US.4c, DE.4c, etc.

III- The changing nature of wealth 1700-2010

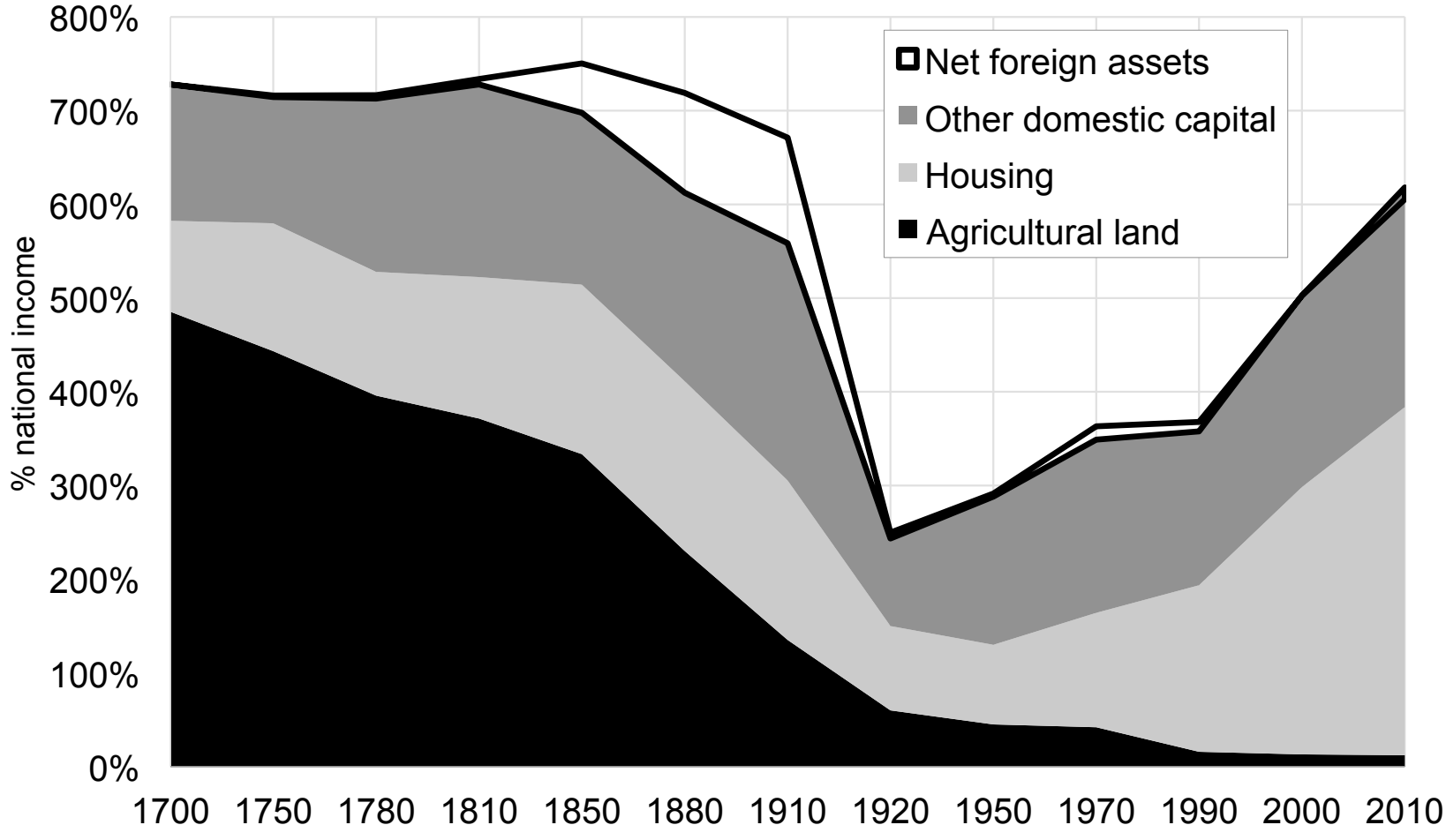
What do we know about pre-1870 β?

- In Europe $\beta \approx$ 600%-700% throughout 18c-19c
- Not far from today despite considerable changes in nature of wealth
- How to explain pre-1870 β levels?
  - One possible explanation is $\beta = s/g$
  - But relative price effects also possible (land values)
  - s series too uncertain to decompose β dynamics
  - "Pure" land values could be less than 50% Y or up to 200%

In order to make progress on these questions, useful to compare value of land in Old Europe and in New World

In 18c Old World, land/Y as high as 400%

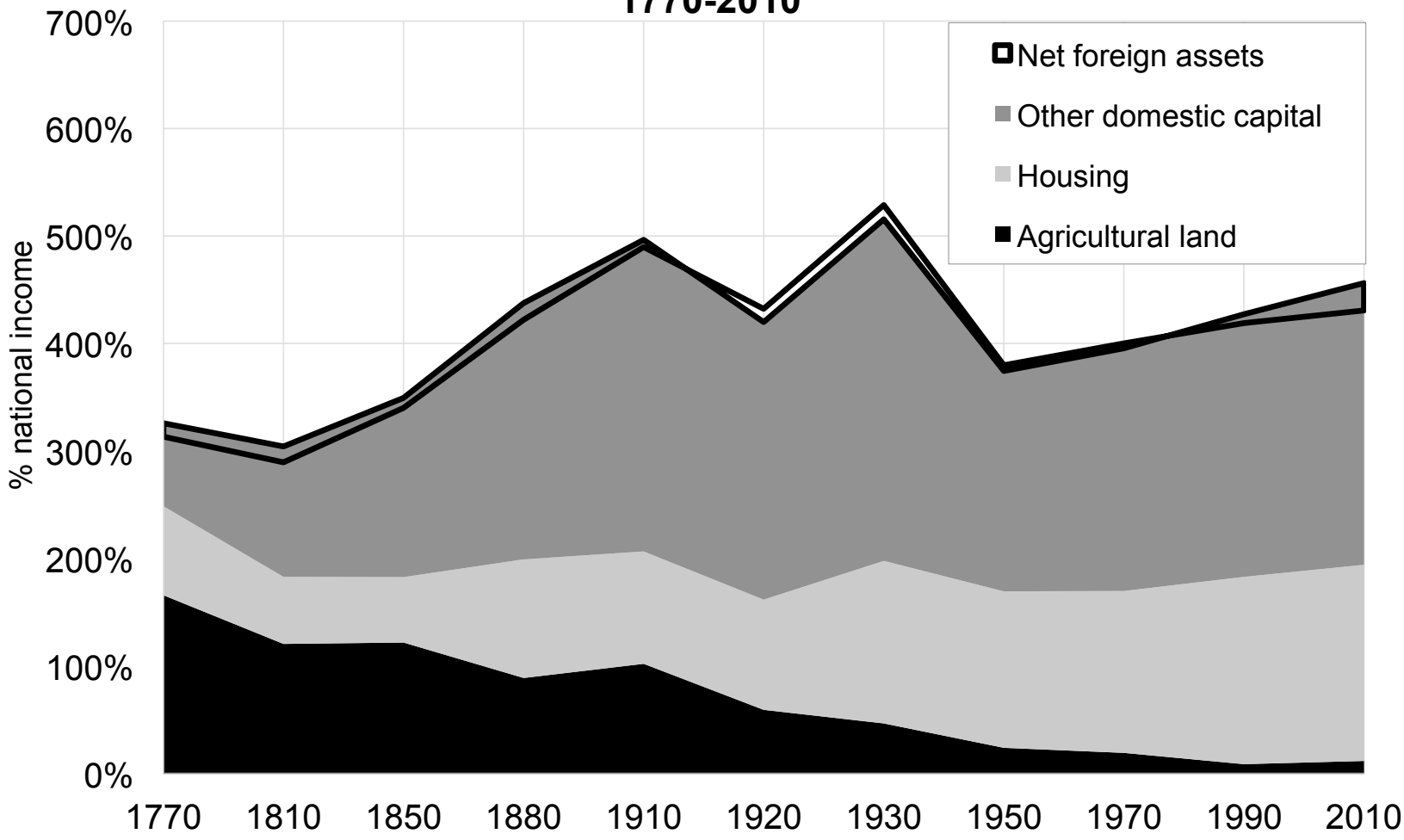
Figure 9: The changing nature of national wealth: France 1700-2010



National wealth = agricultural land + housing + other domestic capital goods + net foreign assets

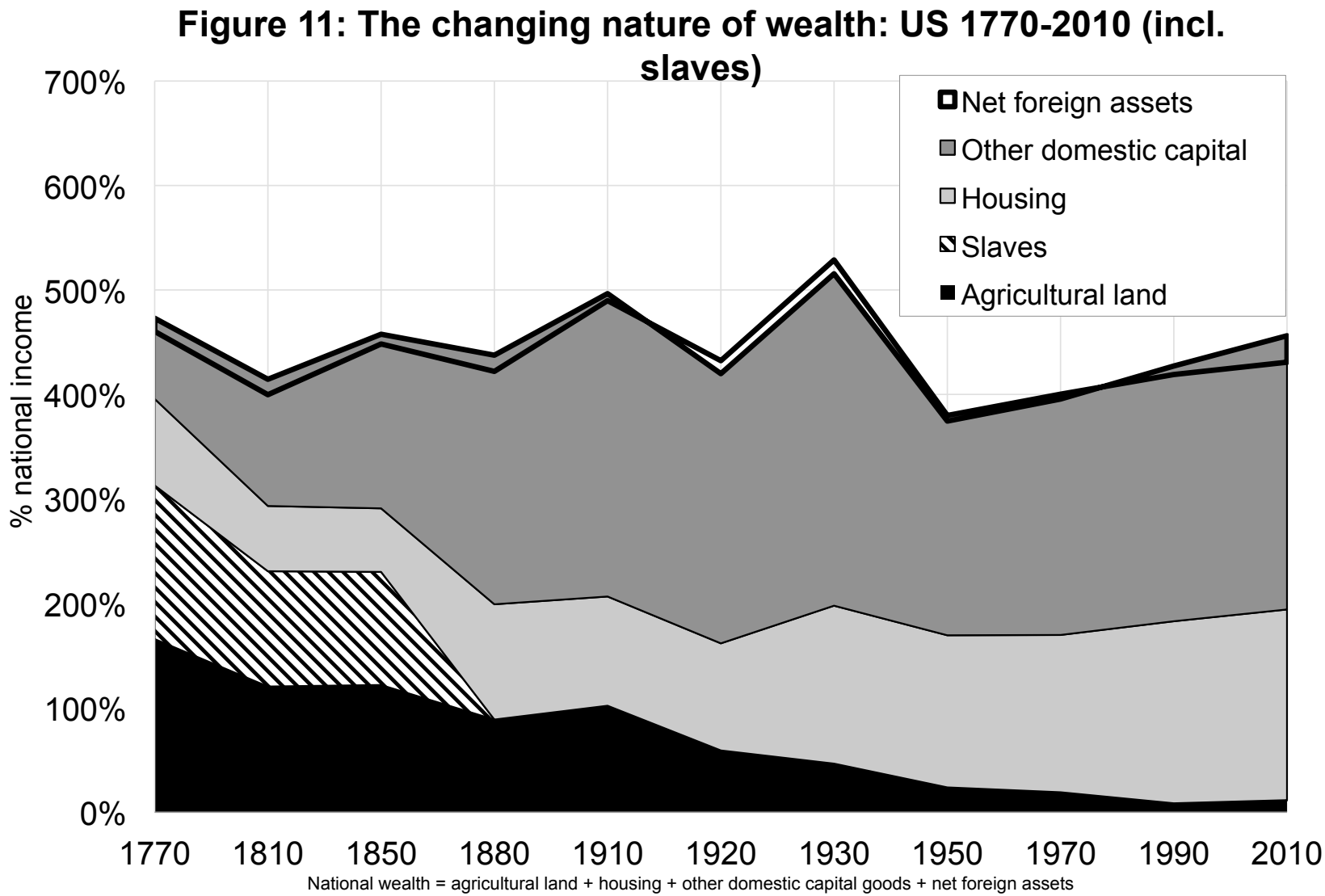
Land in late 18c US was much less than in Old World: abundance effect with $\sigma < 1$

Figure 10: The changing nature of national wealth: US 1770-2010

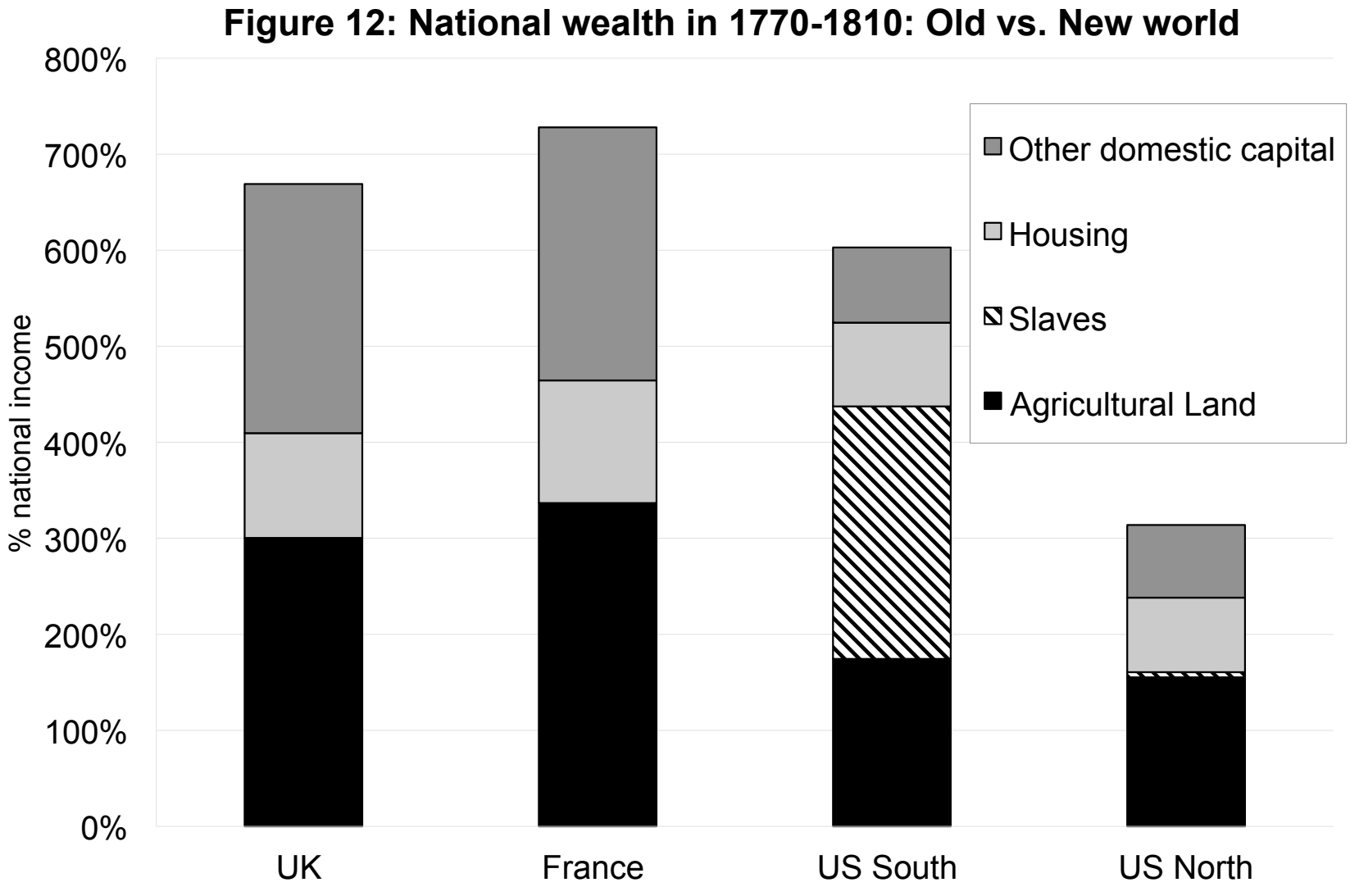


National wealth = agricultural land + housing + other domestic capital goods + net foreign assets

Lower land values in the US were to some extent compensated by the slavery system



There are two ways to be rich in 1810



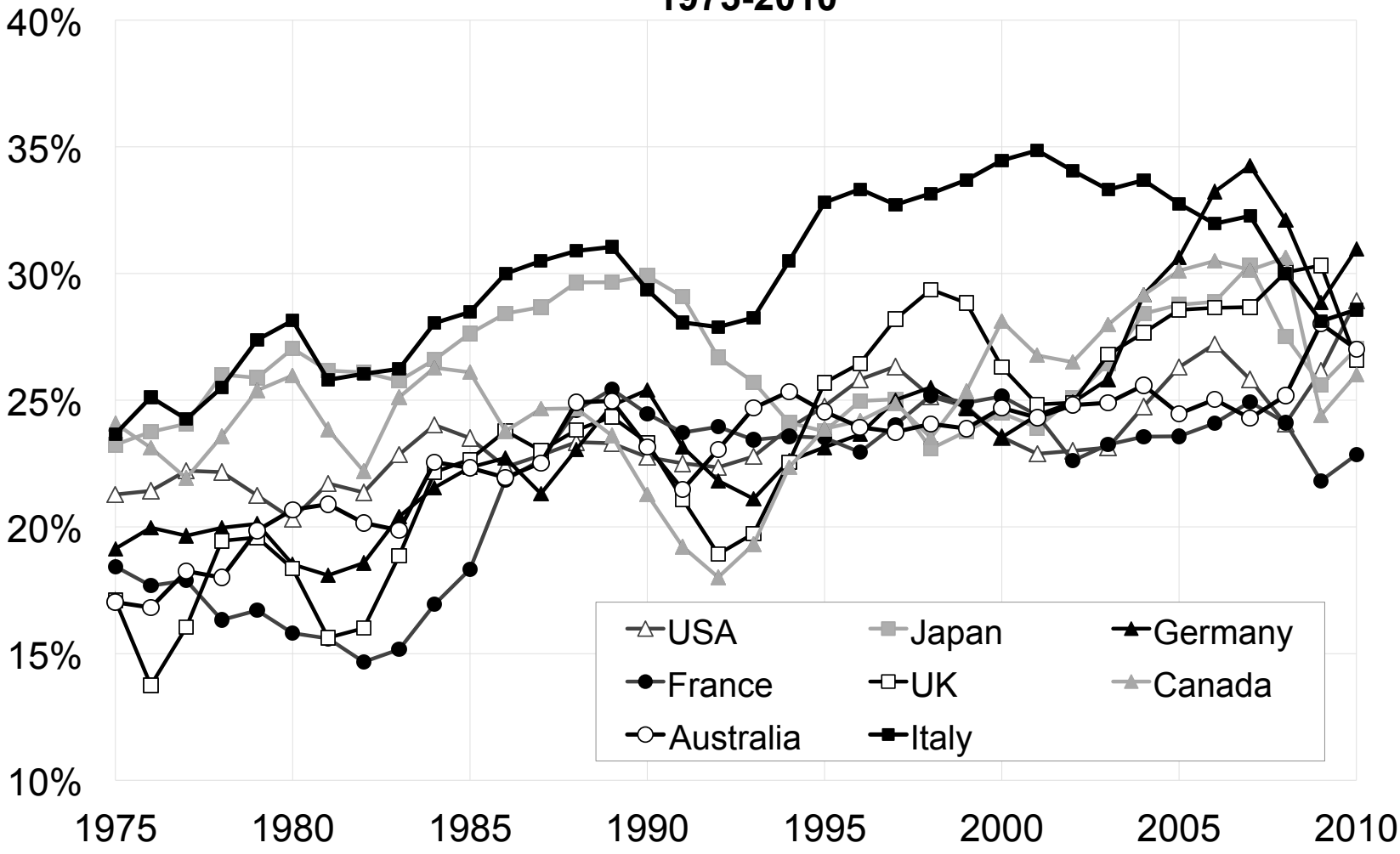
IV - Implications of the return of high wealth-income ratios

The return of high β is not bad per se but raises new issues

- Wealth inequality likely to matter more than in postwar period
- Implications for optimal taxation
- Wide variations in $\beta = s/g$ imply potentially very large net foreign asset positions...
- ... or domestic asset price bubbles (Spain, Japan)
- Rising capital shares with K-L elasticity $\sigma > 1$

With $\sigma > 1$, the rise of β can explain the rise of capital share $\alpha = r\beta$

Figure 13: Capital shares in factor-price national income 1975-2010



σ does not have to be hugely > 1 to account for observed trends

CES production: $F(K, L) = [aK^{\frac{\sigma-1}{\sigma}} + (1-a)L^{\frac{\sigma-1}{\sigma}}]^{\frac{\sigma}{\sigma-1}}$

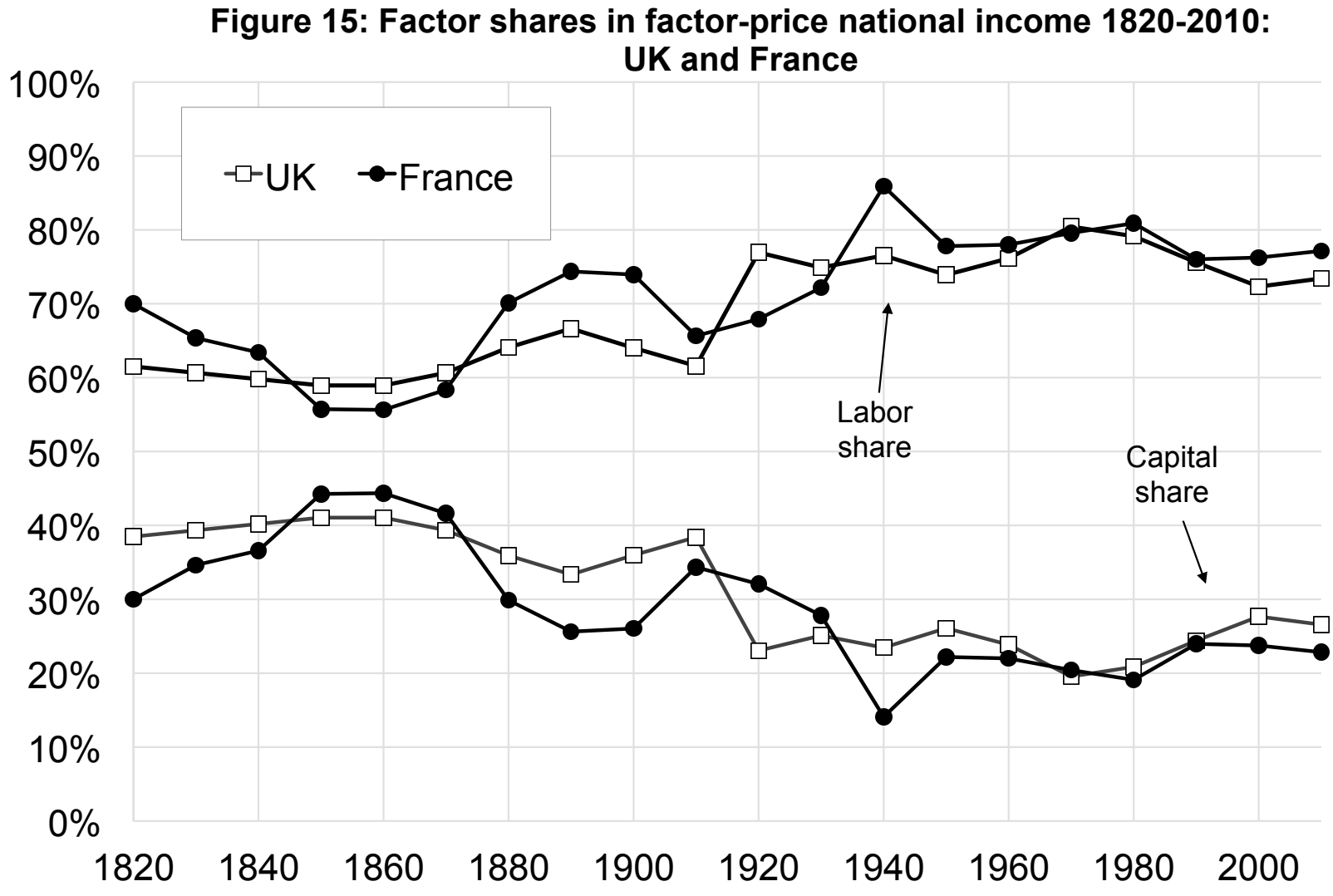
$r = F_K = a\beta_K^{-1/\sigma}$ and capital share $\alpha = r\beta_K = a\beta_K^{\frac{\sigma-1}{\sigma}}$

- If $\sigma = 1.5$, capital share rises from α =28% to α =36% when β_K rises from 250% to 500%
- In case β_K reaches 800%, α would reach 42%
- In case σ=1.8, α would be as large as 53%

$\Downarrow$

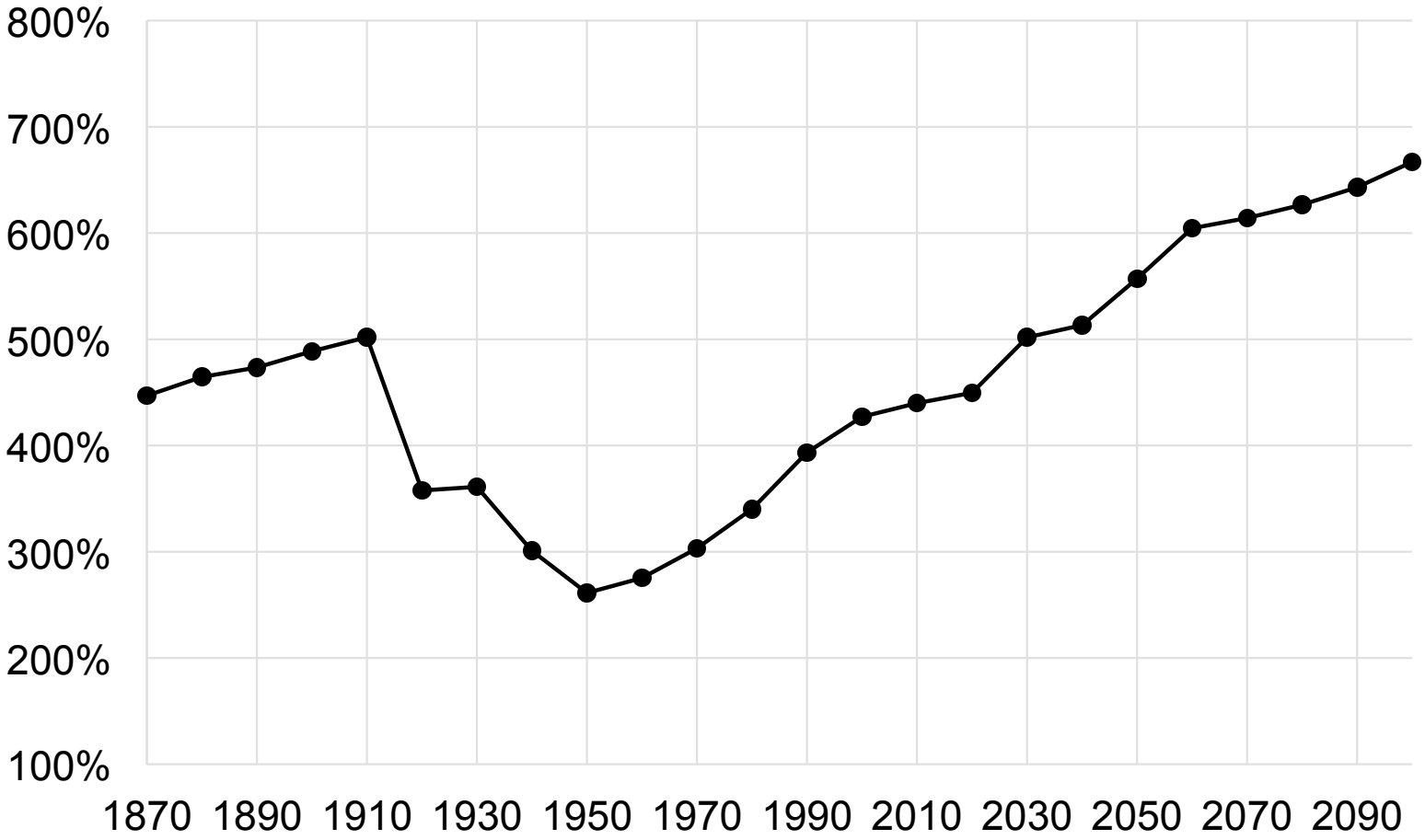
There are powerful forces in the one-good model that push toward high α

Will α get back to its 19c level?



With g low and $\sigma > 1$ the rise of human capital may turn out to be an illusion

Figure 16: World private wealth / national income ratio 1870-2100



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

Conclusion: capital is back

- Low β in 1950s-70s Europe were an anomaly
- With low growth, long run β can be very large (600%-700% or more). Key is $\beta = s/g$
- The return of high β raises a new set of issues about capital regulation and taxation
- Next steps:
  - **Plug distributions:** Will China or global billionaires own the world? With low g both divergence can occur
  - **Normative implications:** relative importance of inherited vs. self-made wealth: 1910-2010 U-shaped pattern in France; on-going work on UK, Germany, and US

Supplementary Slides

Figure 14: Average return on private wealth 1975-2010

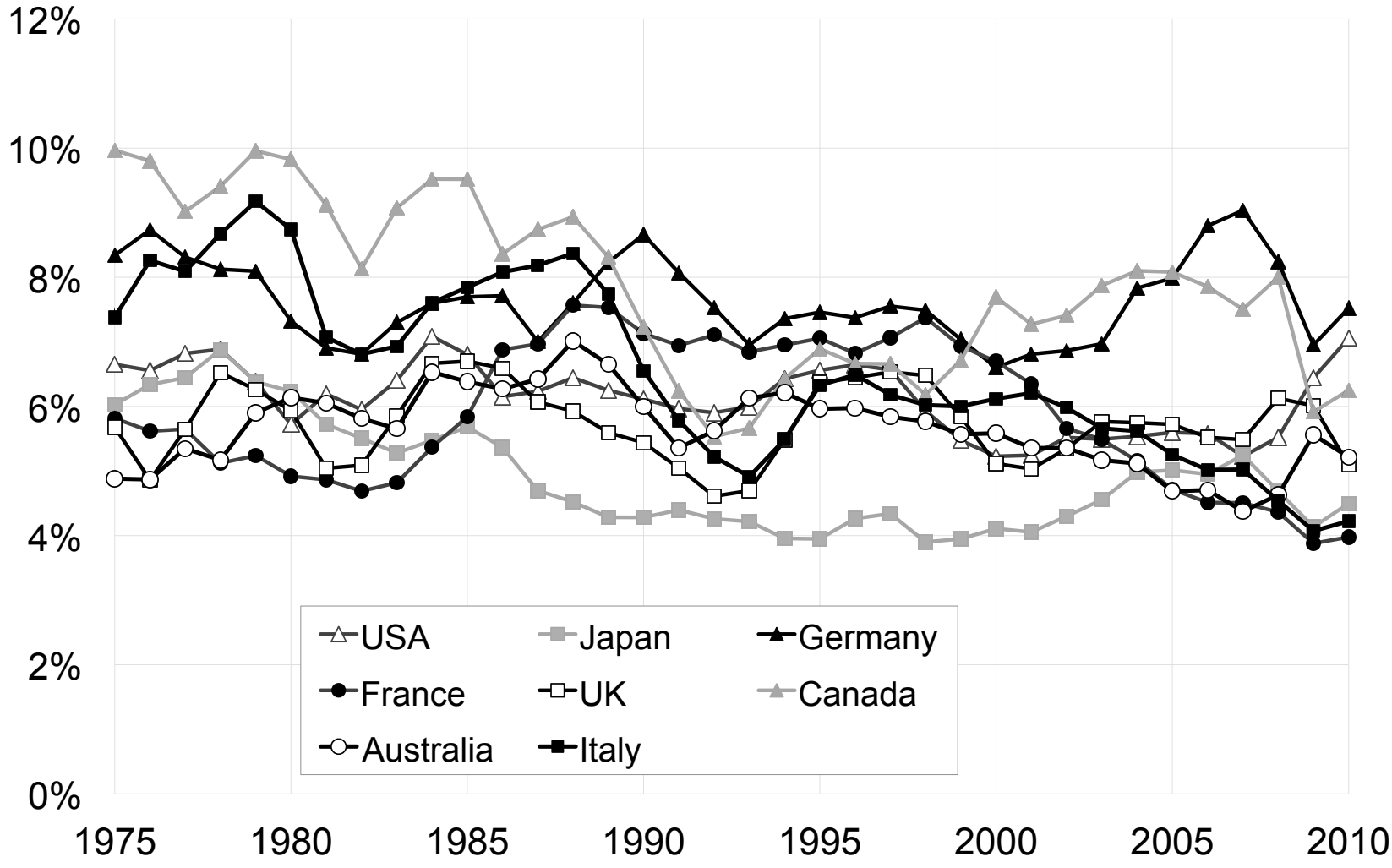


Table 3: Saving rates 1970-2010: national vs. private

Average saving rates 1970-2010 (% national income)	Net national saving (private + government)	Net private savings (personal + corporate)	*incl. personal savings*	*incl. corporate savings (retained earnings)*	Net government saving
U.S.	5.2%	7.7%	4.6% ***60%***	3.1% ***40%***	-2.4%
Japan	14.6%	14.6%	6.8% ***47%***	7.8% ***53%***	0.0%
Germany	10.2%	12.2%	9.4% ***76%***	2.9% ***24%***	-2.1%
France	9.2%	11.1%	9.0% ***81%***	2.1% ***19%***	-1.9%
U.K.	5.3%	7.3%	2.8% ***38%***	4.6% ***62%***	-2.0%
Italy	8.5%	15.0%	14.6% ***97%***	0.4% ***3%***	-6.5%
Canada	10.1%	12.1%	7.2% ***60%***	4.9% ***40%***	-2.0%
Australia	8.9%	9.9%	5.9% ***60%***	3.9% ***40%***	-0.9%

Authors' computations using country national accounts. 1970-2010 averages are obtained by weighthing yearly saving rates by real national income.

Table 5: Accumulation of national wealth in rich countries, 1970-2010: domestic capital vs foreign wealth

	1970 national wealth / national income ratio		2010 national wealth / national income ratio		1970-2010 rise in national wealth / national income ratio	
	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%*

Table 7: Domestic capital accumulation in rich countries, 1970-2010: housing vs other domestic capital

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

1910-1950: war destructions $\approx$ a third of the fall of β in Germany and France

Table 10: Accumulation of national wealth in rich countries, 1910-1950

	National wealth-national income ratios		Decomposition of 1950 national wealth-national income ratio			
	β (1910)	β (1950)	Initial wealth effect	Cumulated new savings	Cumulated war destructions	Capital gains or losses
U.S.	469%	380%	132%	193%	0%	55%
Germany	637%	223%	400%	109% ***31%***	-120% ***29%***	-165% ***40%***
France	747%	261%	421%	144% ***38%***	-132% ***27%***	-172% ***35%***
U.K.	719%	208%	409%	75% ***46%***	-19% ***4%***	-256% ***50%***

Germany's national wealth-income ratio fell from 637% to 223% between 1910 and 1950. 31% of the fall can be attributed to insufficient saving, 29% to war destructions, and 40% to real capital losses.