Rare Disasters and Asset Markets

in the 20th Century

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Some features of asset markets are hard to explain with standard economic models. My research tries to explain these puzzles by the prospect of large, but rare, economic disasters. This study builds on a largely ignored idea by Tom Rietz from 1988.

The large disasters are not just

hypothetical, never seen events. I

"calibrate the model" by studying the

observed frequency of large-scale

economic declines during the 20th

century.

I use long-term GDP data for 35 countries assembled by Angus Maddison. My ongoing research is improving these data and extending to measures of aggregate consumption, which matters more for asset pricing in the theory.

The main economic disasters are associated with World Wars I and II, the Great Depression, and post-WWII crises in Asia and Latin America. Possible future events, aside from wars and financial crises, include natural disasters, epidemics, and so on.

I focus on the "high" equity premium and "low" risk-free rate of return. General approach applies also to other puzzles, such as "high" stock-price volatility, term premium, government-corporate bond spread, value premium, behavior of stock-options prices, relation between exchange rates and interest rates, etc.

Growth Rates and Rates of Return for OECD Countries, 1880-2005

	Mean growth rates				Mean real rates of return		
Country	Δc/c	Δy/y	ΔC/C	ΔY/Y	stocks	bills	bonds
Australia	0.015	0.015	0.032	0.033	0.103	0.012	0.035
Canada	0.021	0.022	0.038	0.039	0.077	0.016	0.035
Denmark	0.018	0.020	0.026	0.028	0.074	0.030	0.038
France	0.016	0.021	0.020	0.025	0.056	-0.011	0.002
Germany	0.023	0.022	0.030	0.027	0.073	-0.018	-0.002*
Italy	0.019	0.022	0.025	0.027	0.049	0.002	0.011
Japan	0.024	0.029	0.034	0.040	0.093	0.004	0.020
Norway	0.020	0.023	0.027	0.030	0.069	0.018	0.026
Sweden	0.020	0.020	0.025	0.026	0.091	0.023	0.031*
U.K.	0.015	0.016	0.019	0.020	0.064	0.017	0.029
U.S.	0.020	0.020	0.034	0.034	0.080	0.014	0.023
Means	**0.019**	**0.021**	**0.028**	**0.030**	**0.075**	**0.010**	**0.023**

Note: c is real per capita personal consumer expenditure, y is real per capita GDP, C is real personal consumer expenditure, and Y is real GDP. Growth rates are for annual data for year t compared to year t-1. Real rates of return are calculated from arithmetic annual returns during each year, based on nominal total return indexes and consumer price indexes. (For some country-years, stock returns are based on stock-price indexes and estimates of dividend yields.) Periods for growth rates are 1881-2005 and for returns are 1880-2005, except for missing data.
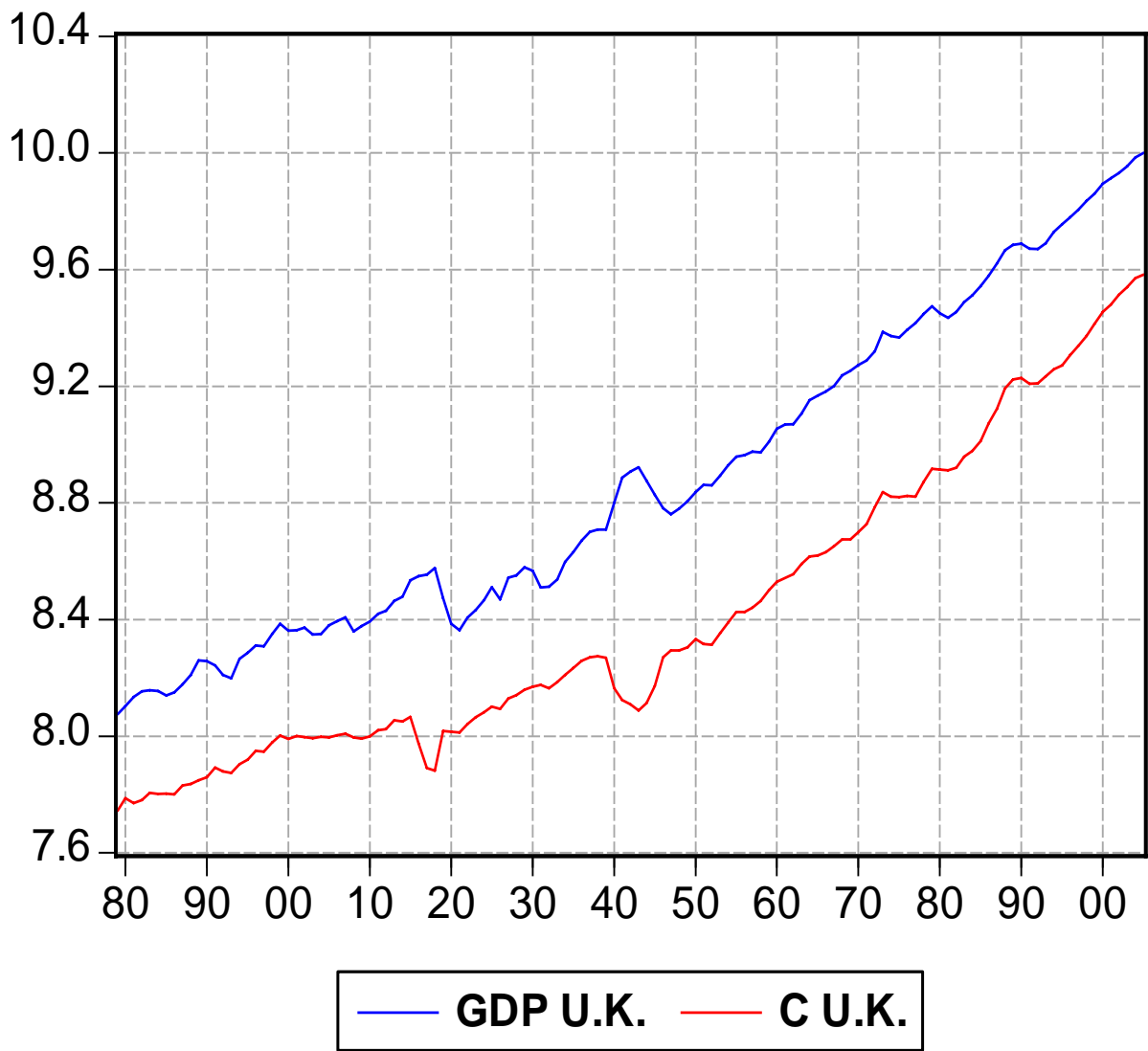
*Based partly on bill returns.

Long-Term Data on per capita GDP

and Consumer Expenditure
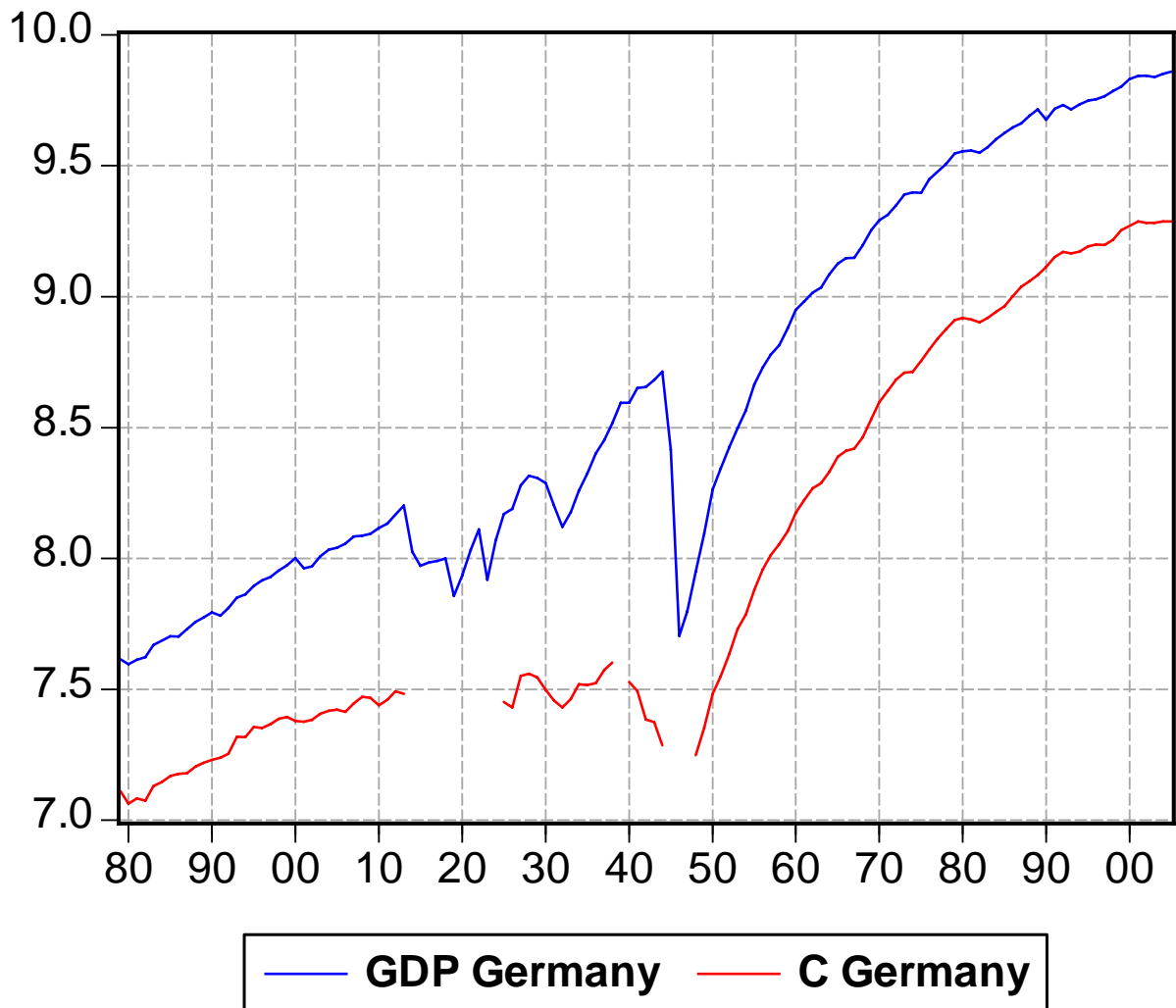
for Selected Countries
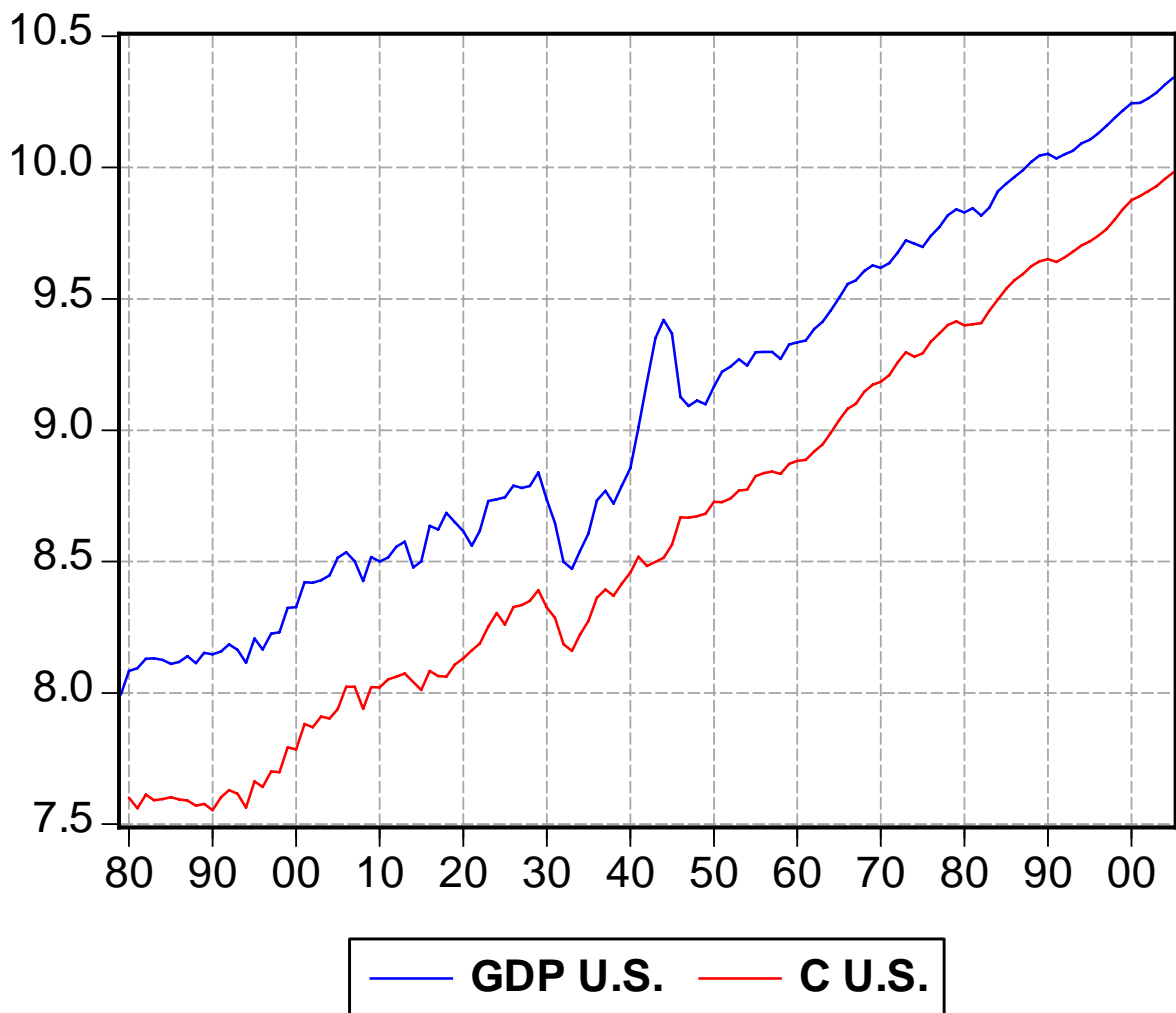
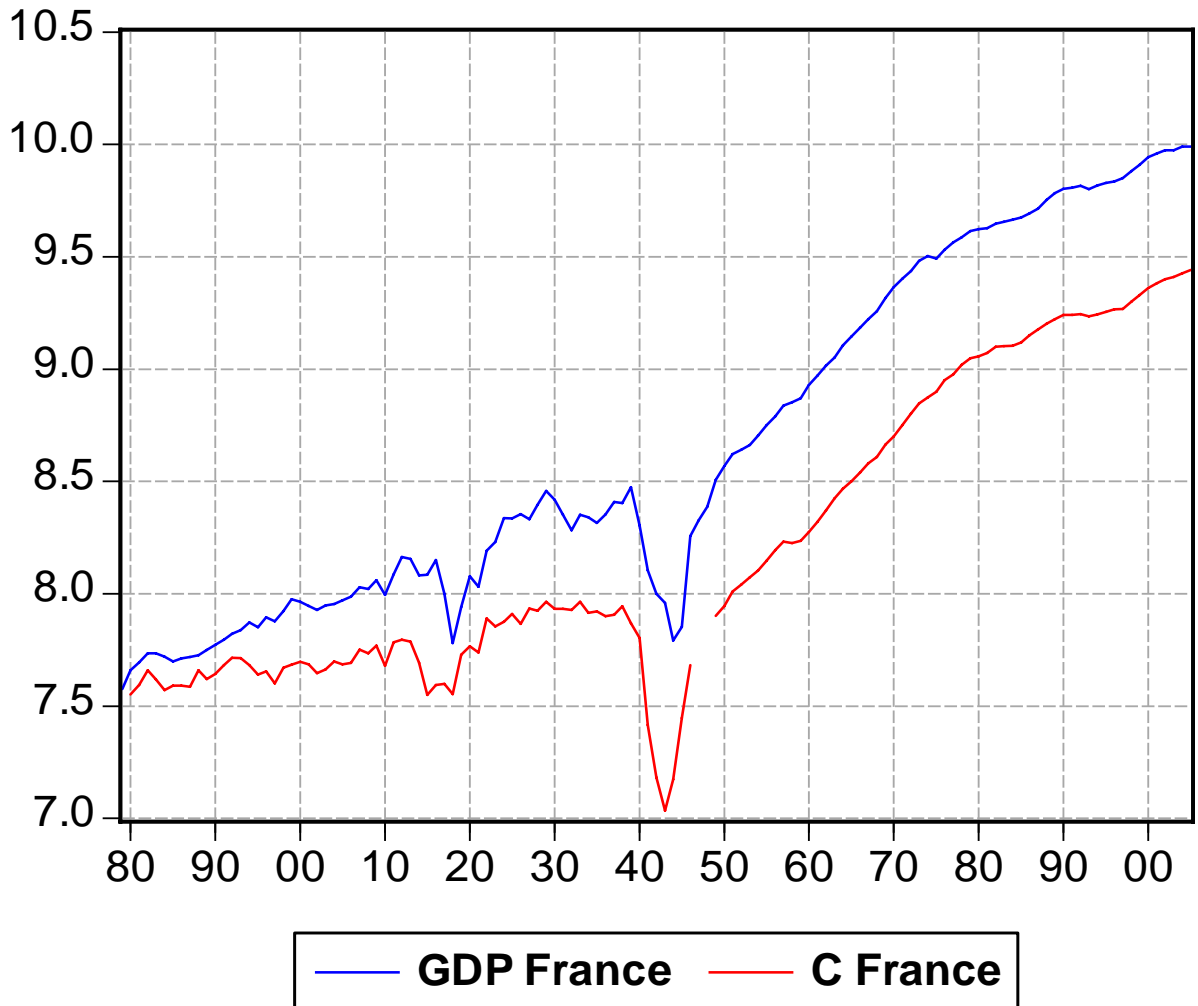**United States**

Per capita GDP and Consumption, 1879-2005

United Kingdom

Per capita GDP and Consumption, 1879-2005
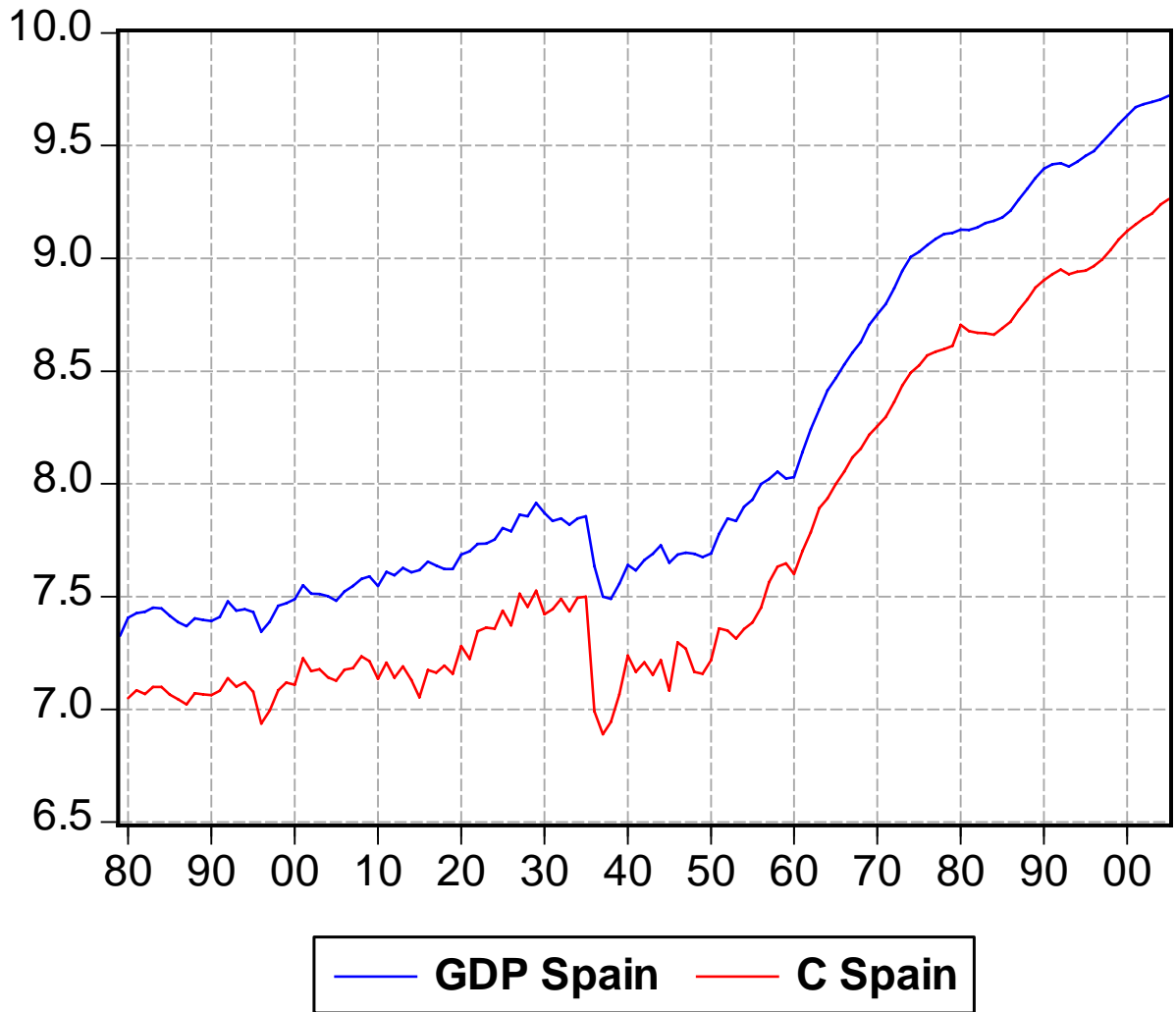
Germany

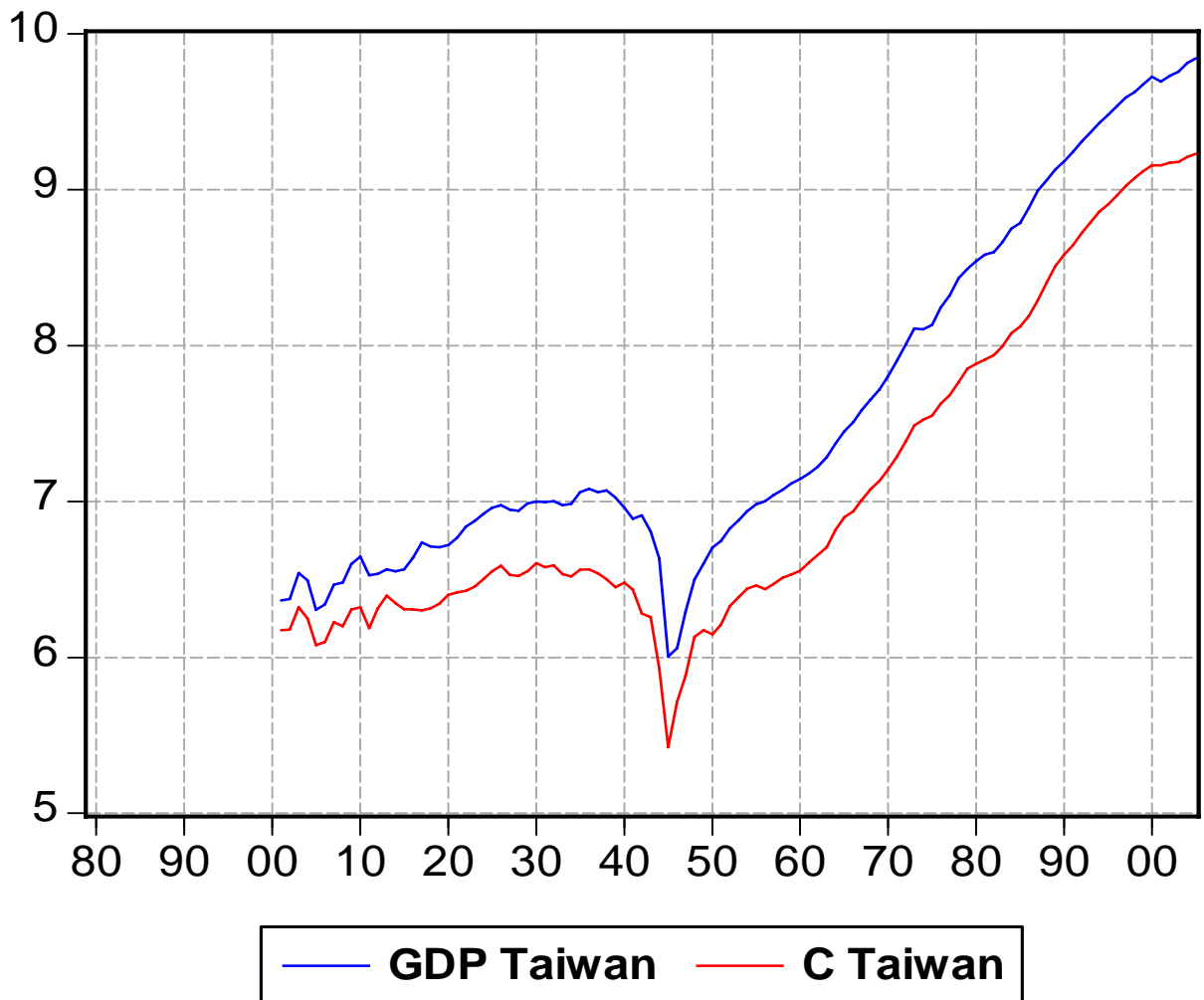**Per capita GDP and Consumption, 1879-2005**

France

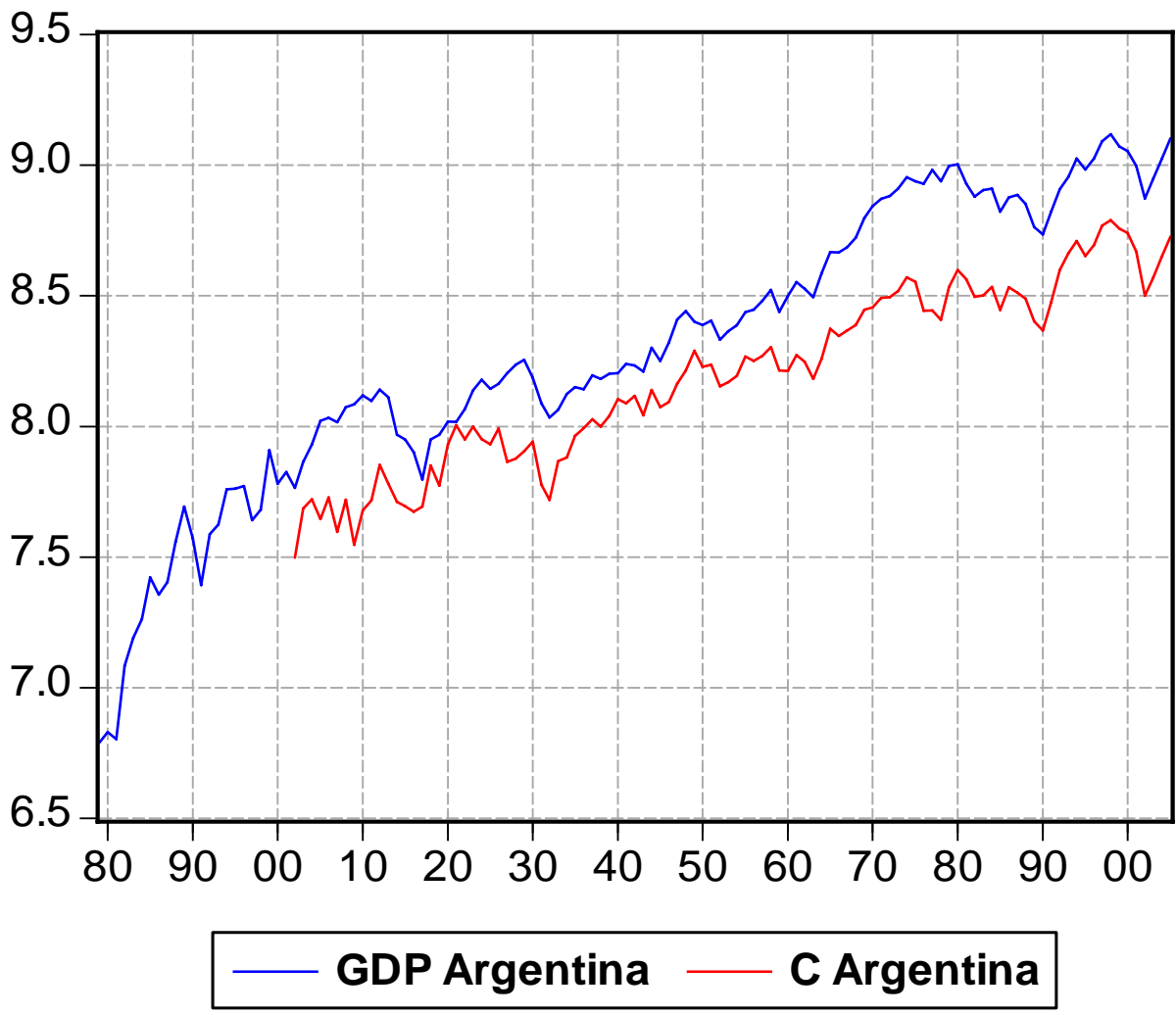**Per capita GDP and Consumption, 1879-2005**

Spain

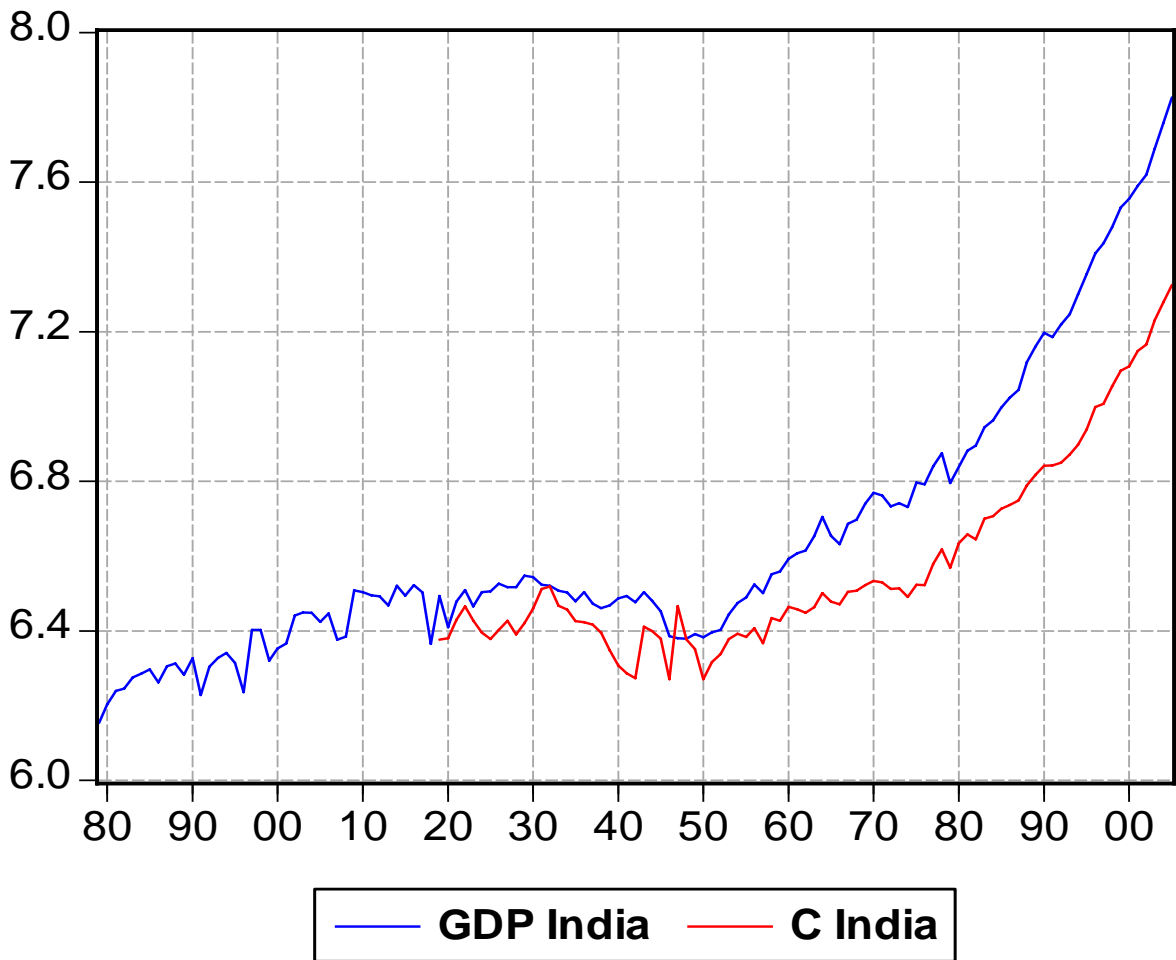**Per capita GDP and Consumption, 1879-2005**

Taiwan

Per capita GDP and Consumption, 1901-2005

Argentina

Per capita GDP and Consumption, 1879-2005

India

Per capita GDP and Consumption, 1879-2005

The Main Economic Crises of

the 20th Century

Declines of 15% or More in Real Per Capita GDP During 20th Century

Part A: 20 OECD Countries in Maddison [2003]

Event	Country	Years	% fall in per capita GDP
World War I	Austria	1913-19	35
	Belgium	1916-18	30
	Denmark	1914-18	16
	Finland	1913-18	35
	France	1916-18	31
	Germany	1913-19	29
	Netherlands	1913-18	17
	Sweden	1913-18	18
Great Depression	Australia	1928-31	20
	Austria	1929-33	23
	Canada	1929-33	33
	France	1929-32	16
	Germany	1928-32	18
	Netherlands	1929-34	16
	New Zealand	1929-32	18
	United States	1929-33	31
Spanish Civil War	Portugal	1934-36	15
	Spain	1935-38	31
World War II	Austria	1944-45	58
	Belgium	1939-43	24
	Denmark	1939-41	24
	France	1939-44	49
	Germany	1944-46	64

	Greece	1939-45	64
	Italy	1940-45	45
	Japan	1943-45	52
	Netherlands	1939-45	52
	Norway	1939-44	20
War Aftermaths	Canada	1917-21	30
	Italy	1918-21	25
	United Kingdom	1918-21	19
	United Kingdom	1943-47	15
	United States	1944-47	28

Part B: Eight Latin American & Seven Asian Countries in Maddison [2003]

Event	Country	Years	% fall in per capita GDP
World War I	Argentina	1912-17	29
	Chile	1912-15	16
	Chile	1917-19	23
	Uruguay	1912-15	30
	Venezuela	1913-16	17
Great Depression	Argentina	1929-32	19
	Chile	1929-32	33
	Mexico	1926-32	31
	Peru	1929-32	29
	Uruguay	1930-33	36
	Venezuela	1929-32	24
	Malaysia	1929-32	17
	Sri Lanka	1929-32	15

World War II	Peru	1941-43	18
	Venezuela	1939-42	22
	Indonesia	1941-49	36
	Malaysia	1942-47	36
	Philippines	1940-46	59
	South Korea	1938-45	59
	Sri Lanka	1943-46	21
	Taiwan	1942-45	51
Post-WWII crises	Argentina	1979-85	17
	Argentina	1998-02	21
	Chile	1971-75	24
	Chile	1981-83	18
	Peru	1981-83	17
	Peru	1987-92	30
	Uruguay	1981-84	17
	Uruguay	1998-02	20
	Venezuela	1977-85	24
	Indonesia	1997-99	15
	Philippines	1982-85	18
Mean for 60 contractions (excluding 5 war aftermaths in part A)			29
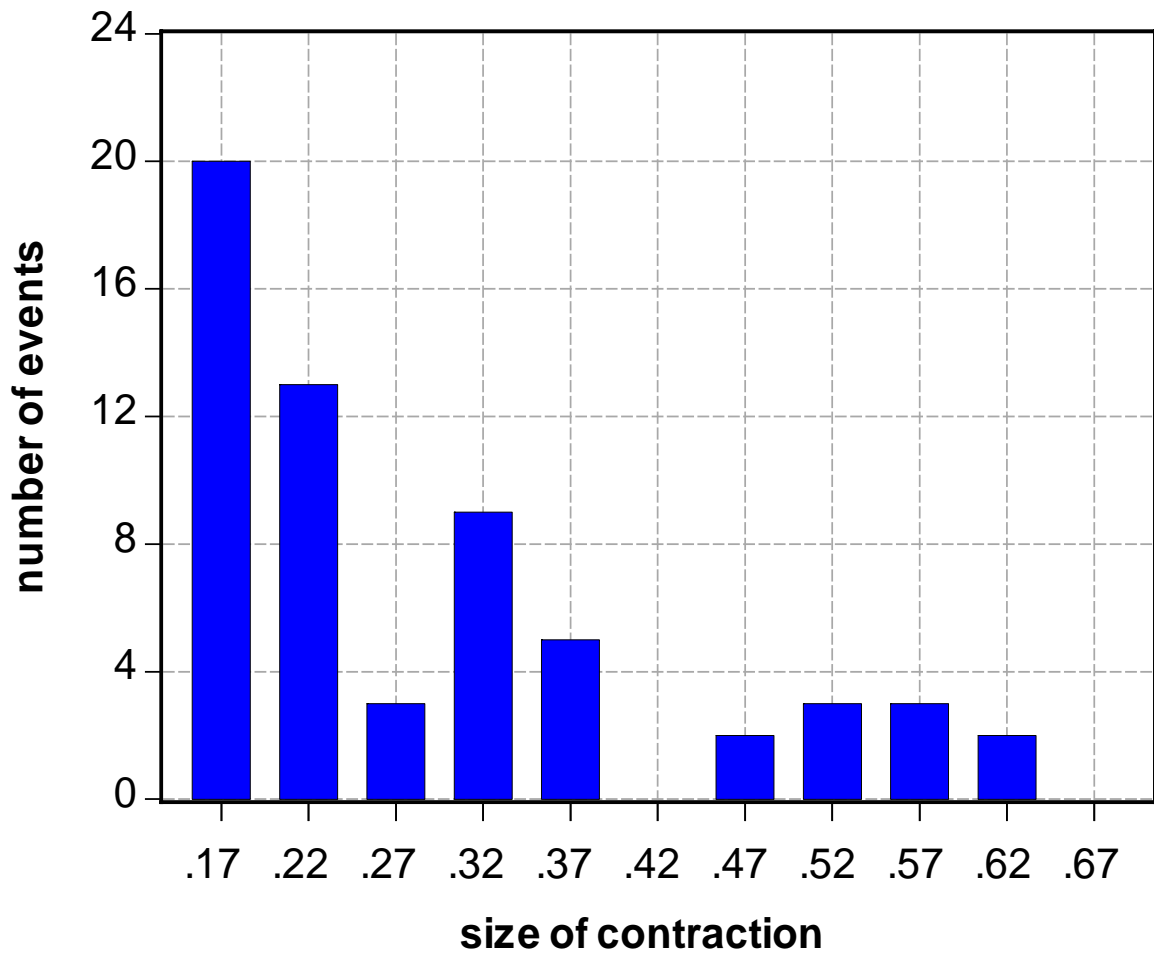
Frequency Distribution of Contraction Sizes

(declines in per capita GDP of 15% or more)

Stock and Bill Returns during Economic Crises

Event	real stock return (% per year)	real bill return (% per year)
World War I		
Austria, 1914-18	--	-4.1
Denmark, 1914-18	--	-6.9
France, 1914-18	-5.7	-9.3
Germany, 1914-18	-26.4	-15.6
Netherlands, 1914-18	--	-5.2
Sweden, 1914-18	-15.9*	-13.1
Great Depression		
Australia, 1928-30	-3.6	8.2
Austria, 1929-32	-17.3*	7.1
Canada, 1929-32	-23.1*	7.1
Chile, 1929-31	-22.3*	--
France, 1929-31	-20.5	1.4
Germany, 1928-31	-14.8	9.3
Netherlands, 1929-33	-14.2*	5.7
New Zealand, 1929-31	-5.6*	11.9
United States, 1929-32	-16.5	9.3
Spanish Civil War		
Portugal, 1934-36	13.4*	3.8
World War II		
Denmark, 1939-45	-3.7*	-2.2
France, 1943-45	-29.3	-22.1
Italy, 1943-45	-33.9	-52.6

Japan, 1939-45	-2.3	-8.7
Norway, 1939-45	1.7*	-4.5

Post-WWII Crises

Argentina, 1998-01	-3.6	9.0
Chile, 1981-82	-37.0*	14.0
Indonesia, 1997-98	-44.5	9.6
Philippines, 1982-84	-24.3	-5.0
Thailand, 1996-97	-48.9	6.0
Venezuela, 1976-84	-8.6*	--

*Based on stock-price indexes, rather than total-return indexes.

A consumption-based asset-pricing model with a representative agent can match observed equity premium and "risk-free" rate with the following specification:

- disaster probability of 2% per year

- distribution of disaster sizes as
  observed

- chance of partial default on bills
  during crises (e.g. from high inflation
  during wars)

- coefficient of relative risk aversion
  around 4

Matching other properties, such as high stock-price volatility, requires some parameters to fluctuate; for example, variations in perceived disaster probability. These changes can also produce large stock-price declines without major economic contractions (e.g. 1987 stock-market crash).