Beyond GDP?
Welfare across Countries and Time

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Maddison Lecture
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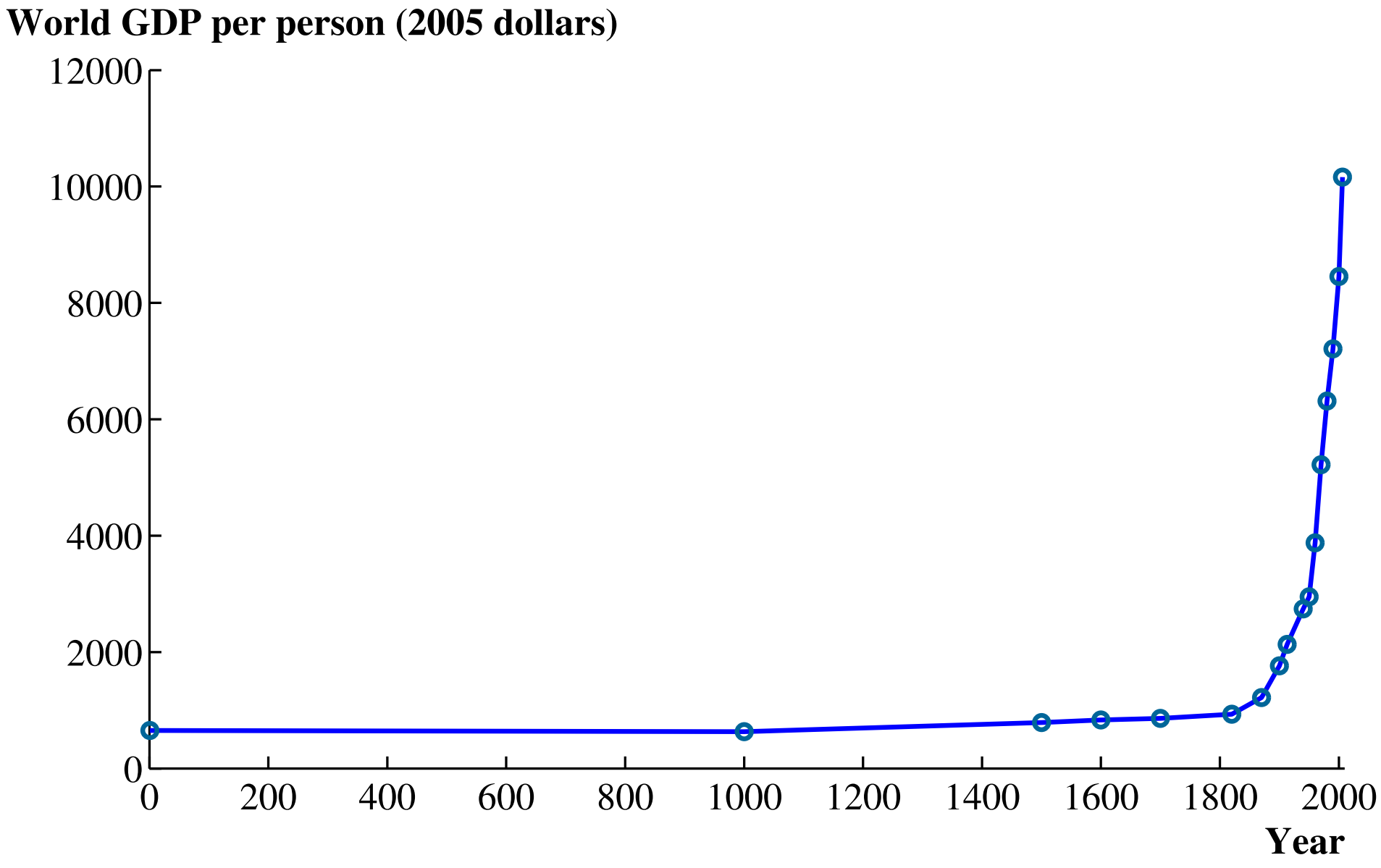
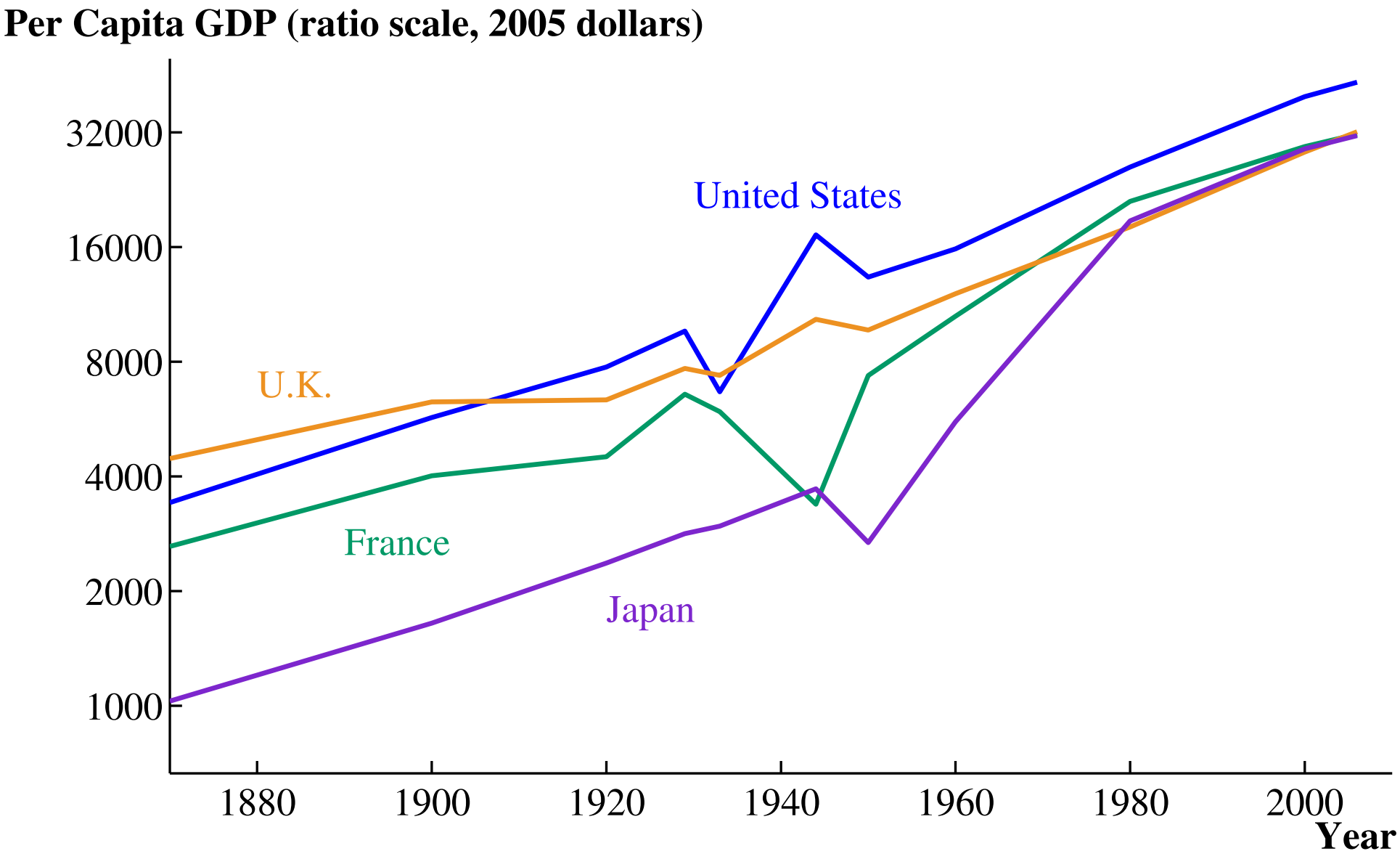
The Famous Maddison Data



The Famous Maddison Data II



Some surprising numbers?

GDP per person in 2006:

United States	100
Netherlands	75
United Kingdom	74
France	73
Germany	64

Western Europe is notably below the U.S.!

Comparing welfare across countries and over time

How successful is an economy at delivering the highest possible welfare for its citizens?

- Fundamental question at the heart of economic growth and development
- Per capita GDP is our standard (shortcut) answer
- Can we do better?

GDP per capita $\neq$ Welfare

Utility depends on:

- Consumption
- Life Expectancy
- Leisure
- Inequality
- ...

But GDP per capita "only" measures income...

Motivating Example 1: France vs. the U.S.

U.S. has higher private consumption

But compared to the U.S., France has:

- More leisure
- Less inequality
- More public consumption (percentage)
- Longer life expectancy

Which country delivers higher welfare, the U.S. or France?

Motivating Example 2: Growth in China

Income has been growing rapidly in China

Amidst the growth:

- Leisure has fallen
- Inequality has risen
- The saving rate has risen (bad, controlling for income!)
- Life expectancy has lengthened

Has welfare risen faster or slower than income in China?

What We Do

Assume:

- Perspective of one set of preferences (those of "Rawls")
- Popular functional form over consumption, leisure, mortality
- Parameters to match U.S. consumption, leisure, value of life

Evaluate outcomes:

- Expected utility "behind the Rawlsian veil" in each country-year
- Fraction of U.S. consumption which makes "Rawls" indifferent

Two approaches:

- Micro calculation: Household surveys for 13 countries.
- Macro calculation: Multi-country public data for 159 countries.

Important Shortcomings of our Approach

Factors we do not capture

- Morbidity (other than through health spending)
- Quality of the natural environment
- Political freedoms
- Crime
- ....

But neither does income!

Summary of Results

- Income and welfare are highly correlated in both levels and growth rates.
- Nevertheless, differences between income and welfare are economically important:
  - Median deviation in levels is over 35 percent.
  - Median deviation in growth rates is about 1 percentage point.

Related Literature

Nordhaus and Tobin's "Measure of Economic Welfare"

- Consumption and Leisure in the U.S. over time
- No Inequality or Life Expectancy, no country comparisons

U.N. Human Development Index

- Adds [0,1] Income, Life Expectancy, Literacy
- Ravallion (2010) "mashup" critique

Becker, Philipson, and Soares (2005)

- Combines per capita GDP and life expectancy $\Rightarrow$"full income"
- Mainly focused on evolution of cross-section dispersion

Fleurbaey and Gaulier (2009)

- Full-income measure of life expectancy, leisure, and inequality
- OECD only, levels only, not consumption-based

Theory Underlying Our Calculations

Let Rawls “live” an entire life as a random person in some country/year, facing its mortality and consumption/leisure distributions.

Preferences

Expected utility behind the Rawlsian veil of ignorance:

$$U = \mathbb{E} \sum_{a=1}^{100} \beta^a u(C_a, \ell_a) S(a)$$

C = individual's consumption.

ℓ = leisure or time spent in home production.

$S(a)$ = probability live until age a.

Uncertainty: consumption, leisure, and lifetime.

Consumption Equivalent Welfare

- Like Lucas (1988) welfare cost of business cycles
- Consider utility in country i if consumption reduced by factor λ:

$$U_i(\lambda) = \mathbb{E}_i \sum_{a=1}^{100} \beta^a u(\lambda C_{ai}, \ell_{ai}) S_i(a)$$

- Consumption equivalent welfare in country i relative to the U.S. is then λ_i s.t.

$$U_{us}(\lambda_i) = U_i(1)$$

An Illustrative Example

- Flow utility:

$$u(c, \ell) = \bar{u} + \log c + v(\ell)$$

- Consumption log normal, independent of age
- No leisure inequality
- No discounting or exponential consumption growth
- Let e denote life expectancy

$$U_i^{\text{simple}} = e_i(\bar{u} + \log \bar{c}_i + v(\bar{\ell}_i) - \frac{1}{2} \cdot \sigma_i^2)$$

Then consumption-equivalent welfare is

$$\log \lambda_i^{\text{simple}} = \frac{e_i - e_{us}}{e_{us}}\left(\bar{u} + \log \bar{c}_i + v(\bar{\ell}_i) - \tfrac{1}{2}\sigma_i^2\right) \quad \text{Life expectancy}$$

$$+ \log \bar{c}_i - \log \bar{c}_{us} \quad \text{Consumption}$$

$$+ v(\bar{\ell}_i) - v(\bar{\ell}_{us}) \quad \text{Leisure}$$

$$- \tfrac{1}{2}(\sigma_i^2 - \sigma_{us}^2) \quad \text{Inequality}$$

Calculation with Household Survey Data

- Allow arbitrary (non-normal) distribution of consumption
- Correlation with age as in data
- Drop durables (lumpy)
- Individual (rather than household) consumption
- Better measure of hours worked if non-OECD
- Incorporate inequality in leisure
- Adjust for age composition of population
- Make sure consumption (not income) inequality
- Incorporate survival rates by age
- Uniform use of sampling weights
- Allow government consumption to lower inequality (if desired)

Calculation with Household Survey Data

$$\log \frac{\lambda_i}{\tilde{y}_i} = \sum_a \Delta s_a^i u_a^i \quad \text{Life expectancy}$$

$$+ \log \bar{c}_i/y_i - \log \bar{c}_{us}/y_{us} \quad \text{Cons. share}$$

$$+ v(\bar{\ell}_i) - v(\bar{\ell}_{us}) \quad \text{Leisure}$$

$$+E \log c^i - \log \bar{c}^i - (E \log c^{us} - \log \bar{c}^{us}) \quad \text{Cons. inequality}$$

$$+Ev(\ell^i) - v(\bar{\ell}^i) - (Ev(\ell^{us}) - v(\bar{\ell}^{us})) \quad \text{Leisure inequality}$$

Data / Calibration

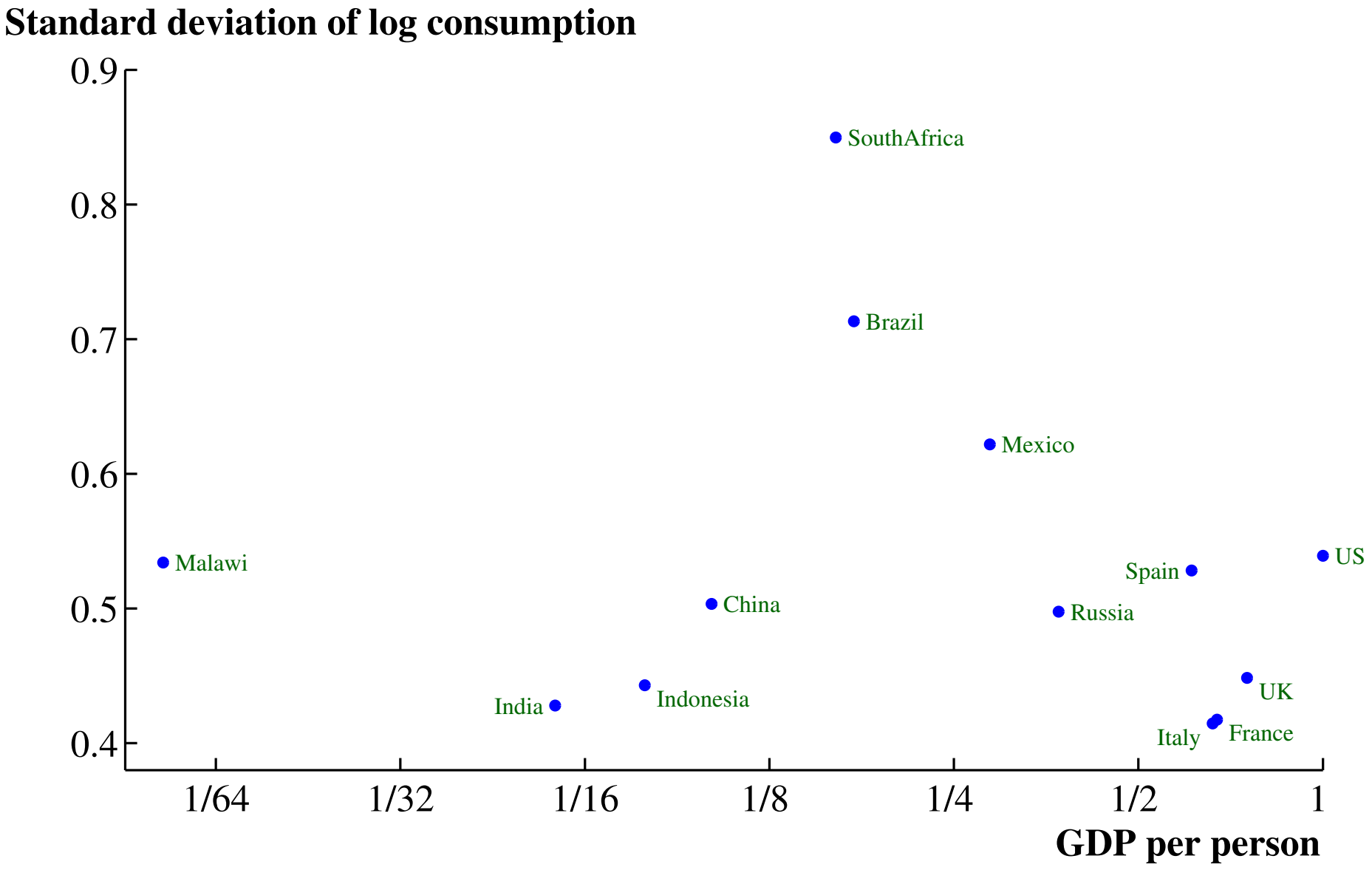
Data Sources

- **Household surveys:**
  - Individual consumption
  - Individual hours worked
- **Penn World Tables:**
  - Average private consumption
  - Average public consumption
  - Average GDP per person
- **World Health Organization:**
  - Age-specific mortality rates
  - Years: 1990, 2000, 2011

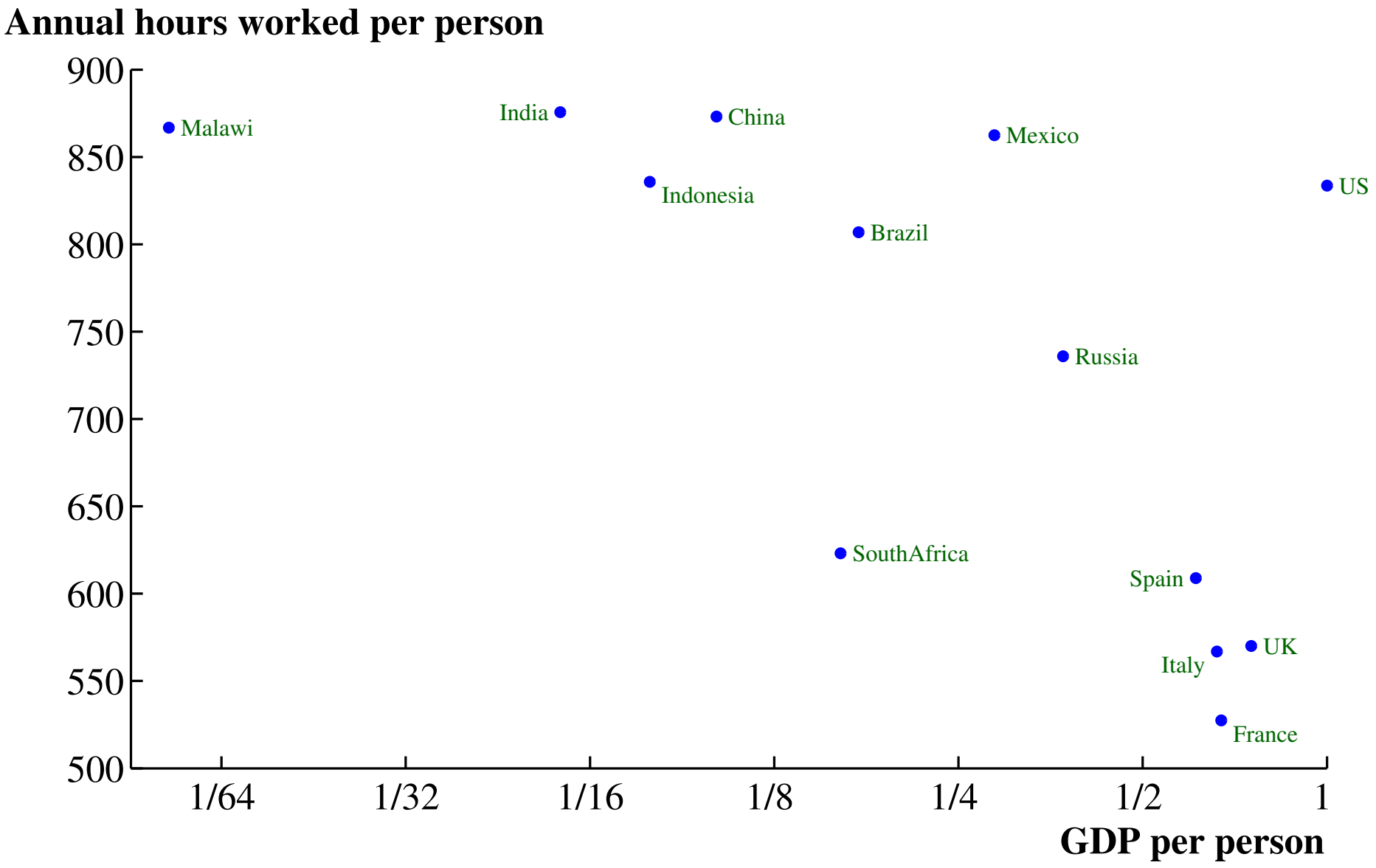
Household Surveys

Country	Years	# of Individuals
U.S.	1984–2006	25,000
Brazil	2003–2008	250,000
China	2004	60,000
France	1984–2005	30,000
India	1983–2005	600,000
Indonesia	1993–2006	1.1m
Italy	1987–2006	20,000
Malawi	2004	50,000
Mexico	1984–2006	80,000
Russia	1998–2007	10,000
South Africa	1993	40,000
Spain	2001	25,000
U.K.	1985–2005	10,000

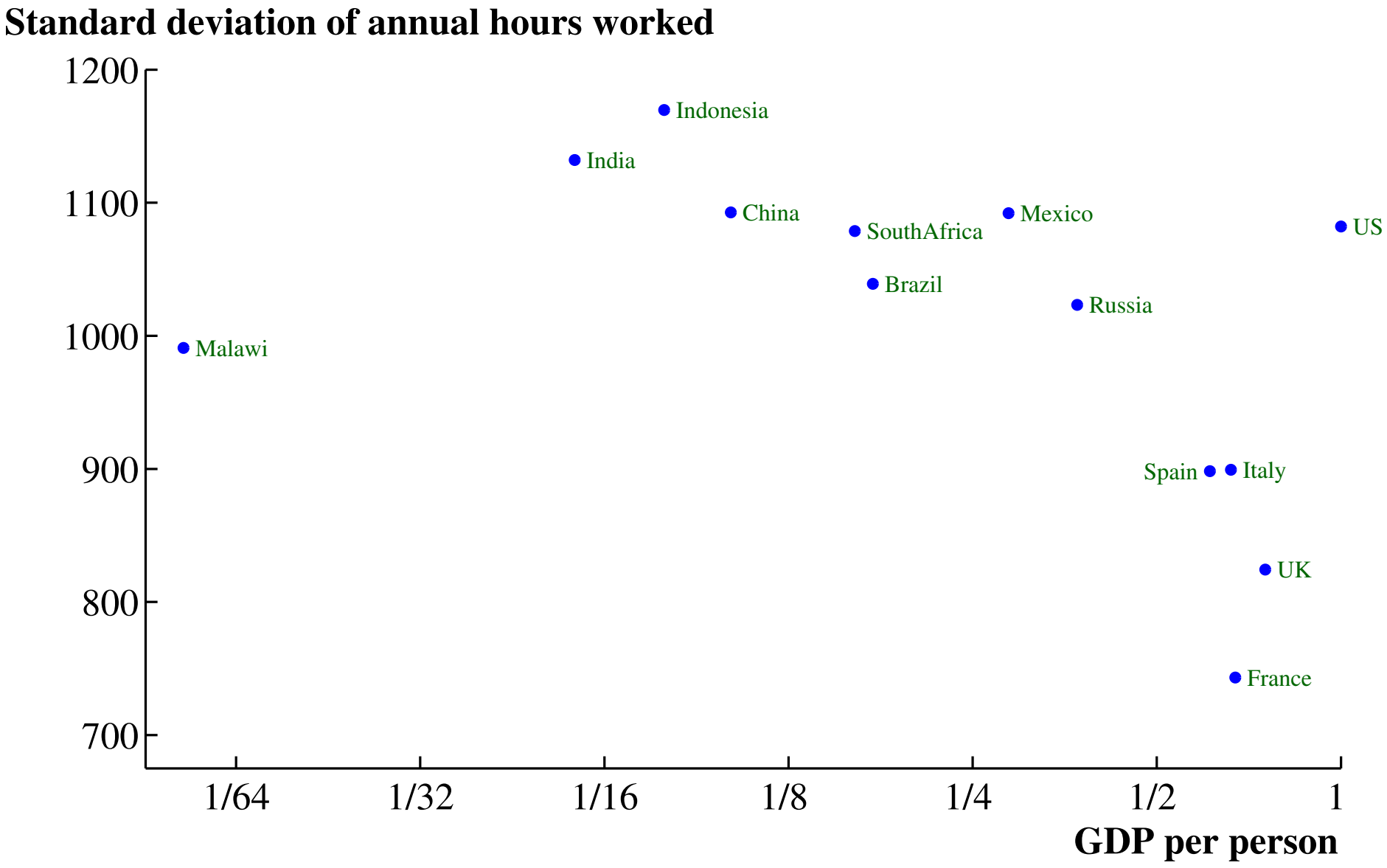
Consumption Inequality



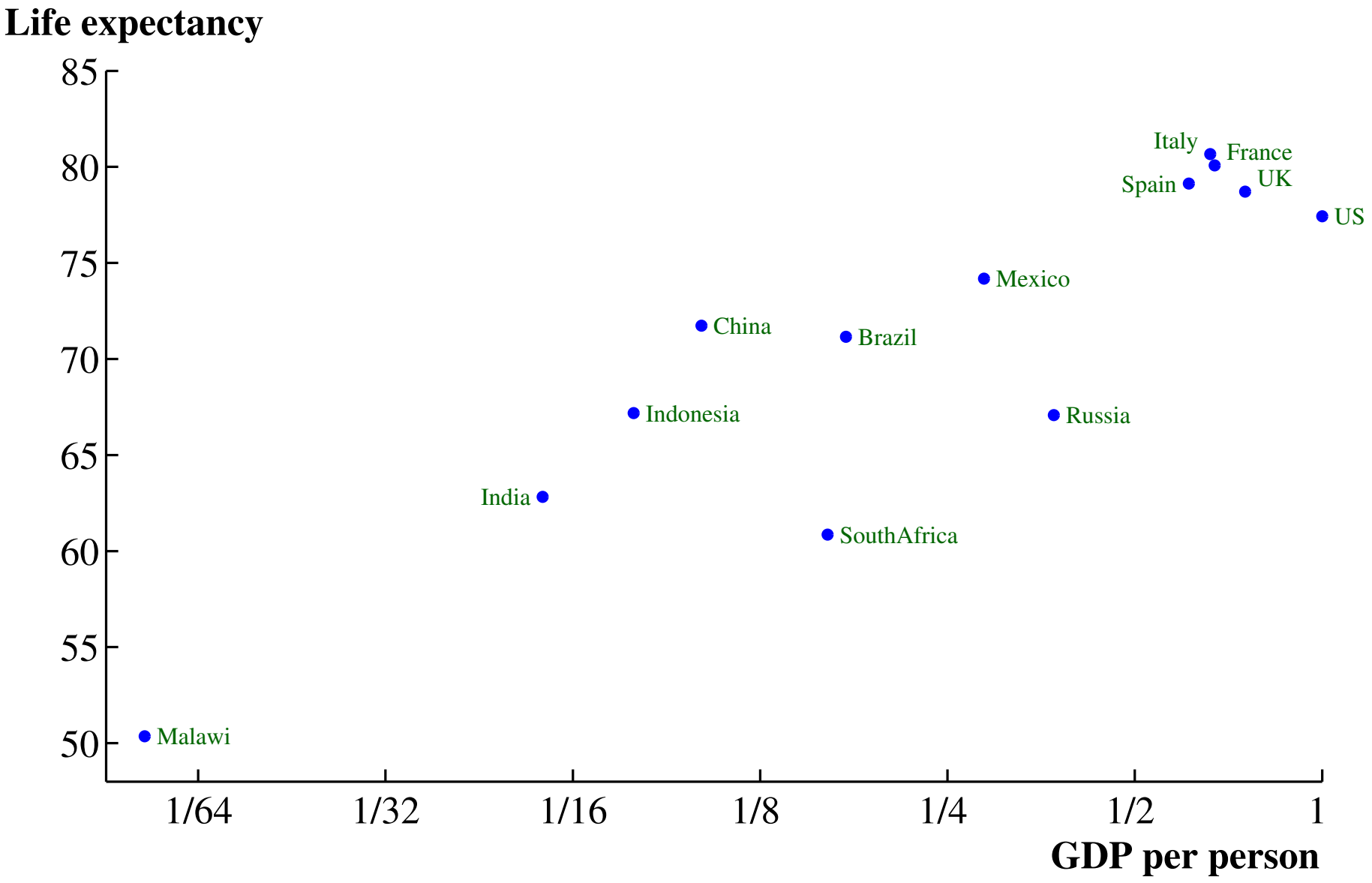
Leisure or Home Production



Leisure Inequality



Life Expectancy



Calibration of the Utility Function

$$U_i = \mathbb{E}_i \sum_{a=1}^{100} \beta^a \left(\bar{u} + \log(c_{ia} e^{ga}) + v(\ell_{ia}) \right) S_i(a)$$

- Rate of time preference and growth
  - $\beta = 0.99$, $g = .02$
- Parameters related to leisure: $v(\ell)$
  - Frisch elasticity of labor supply = 1
  - Average U.S. middle-aged worker satisfies FOC (when MTR=35.3%)
- Intercept in flow utility: $\bar{u}$
  - Value of remaining life for U.S. 40-year-old is $6 million
  - See Murphy and Topel (2006) and Hall and Jones (2007)

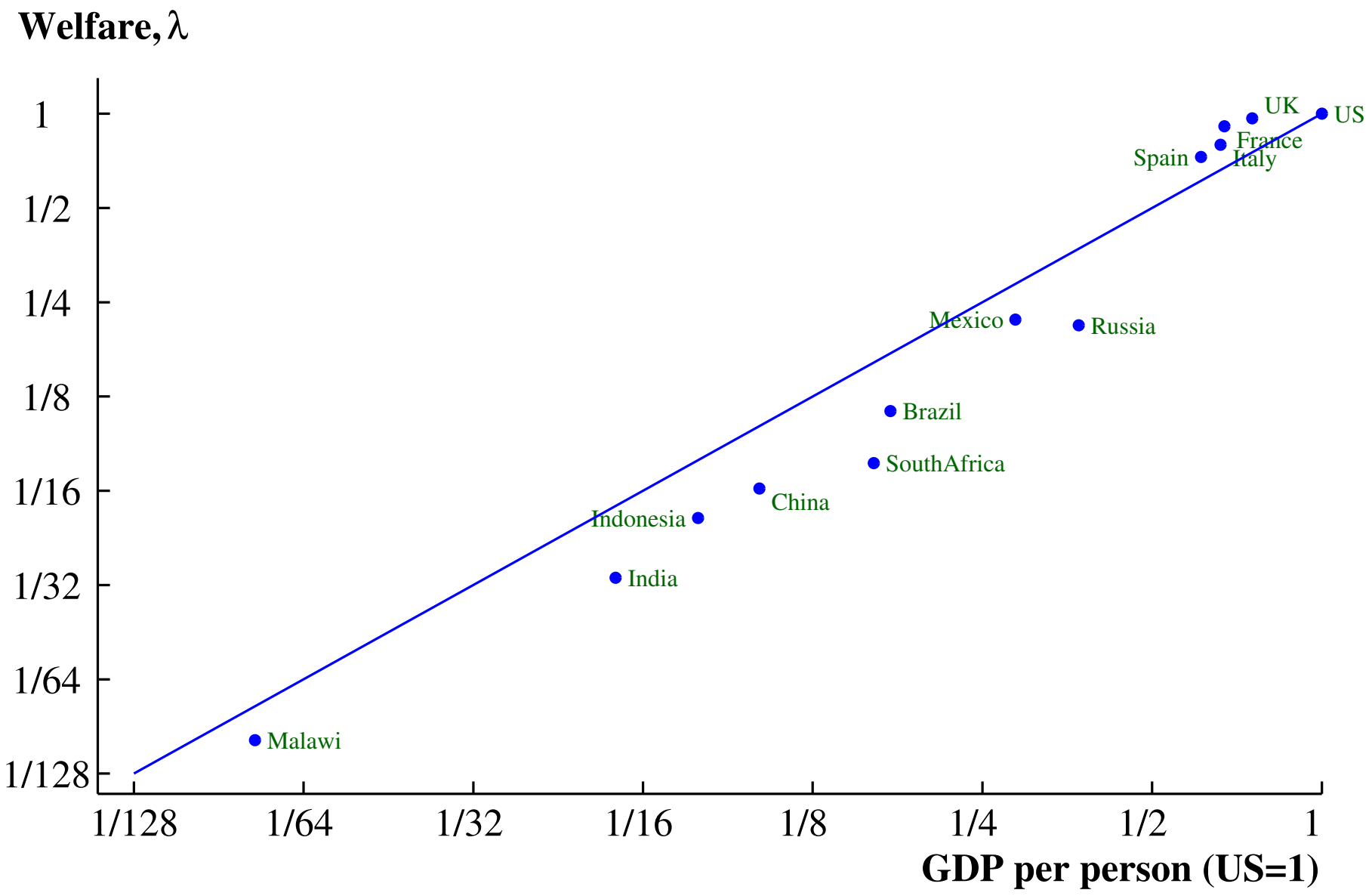
Main Results

Key Point 1:

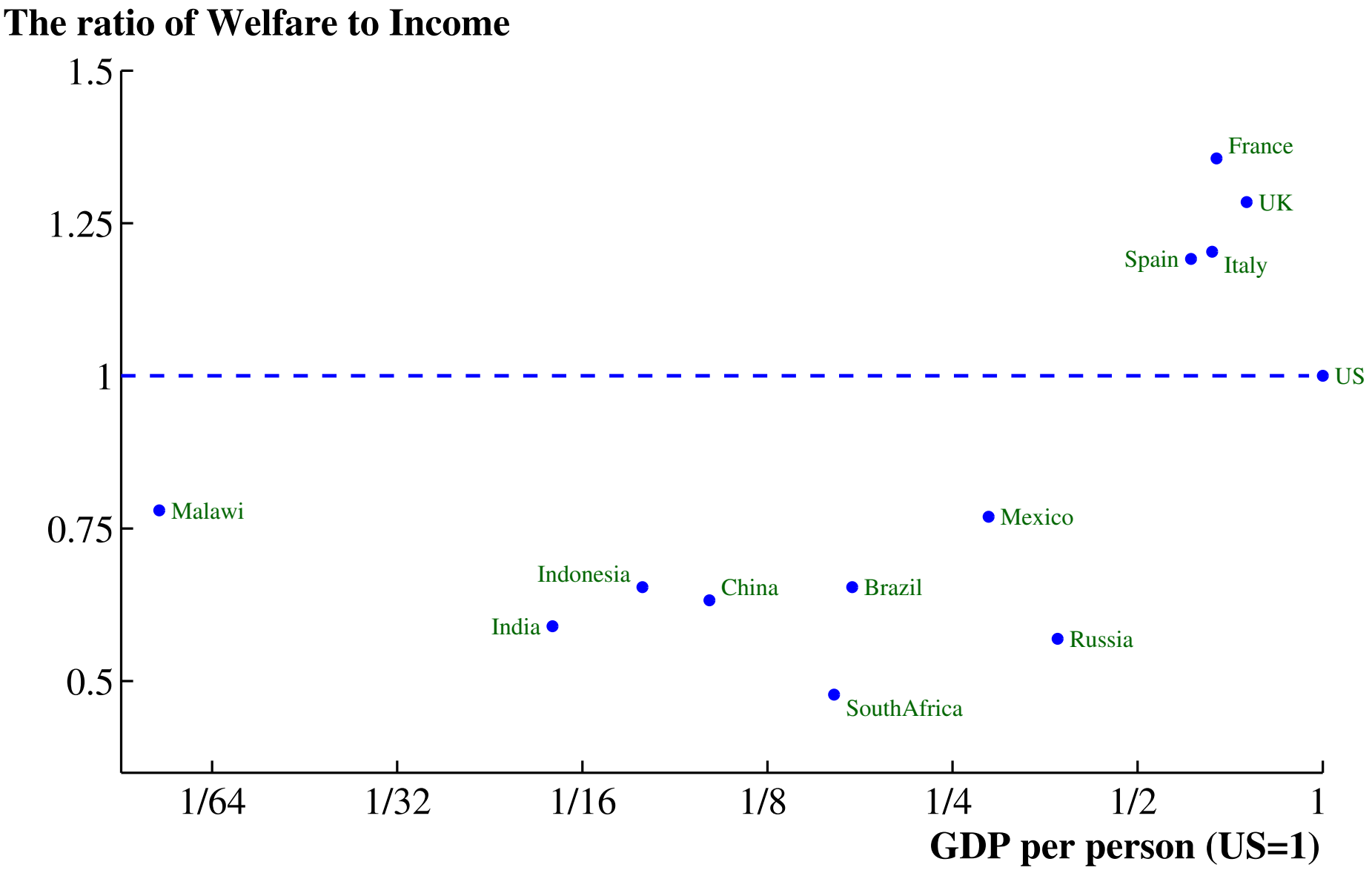
(a) GDP per person highly correlated with welfare across the broad range of countries: 0.95.

(b) Nevertheless, differences are often important: typical deviation is 35%.

Welfare and Income are correlated 0.95



But Welfare typically differs from Income by about 35%



Key Point 2: Western Europe is much closer to the U.S. when we take into account Europe's longer life expectancy, additional leisure, and lower inequality.

U.S. vs. France in 2005

				Decomposition				
	λ	Income	Log Ratio	Life Exp.	C/Y	Leis.	Cons. Ineq.	Leis. Ineq
U.S.	100.0	100.0	.000	.000	.000	.000	.000	.000
				77.4	.854	834	.539	1082
France	91.1	67.2	.305	.149	-.115	.083	.064	.124
				80.1	.768	527	.417	743

- Western Europe's high taxes and generous social safety net may reduce work effort and GDP.
- But these programs have *benefits* that are not measured by GDP...

U.S. vs. Western Europe

				Decomposition				
	λ	Income	Log Ratio	Life Exp.	C/Y	Leis.	Cons. Ineq.	Leis. Ineq
U.S.	100.0	100.0	.000	.000	.000	.000	.000	.000
				77.4	.854	834	.539	1082
U.K.	96.6	75.2	.250	.083	-.055	.073	.052	.097
				78.7	.815	570	.449	824
France	91.1	67.2	.305	.149	-.115	.083	.064	.124
				80.1	.768	527	.417	743
Italy	79.6	66.1	.185	.175	-.203	.078	.060	.075
				80.7	.697	567	.415	899
Spain	72.8	61.1	.175	.128	-.096	.070	-.000	.073
				79.1	.759	609	.528	898

Key Point 3: Many developing countries are poorer than incomes suggest because of

- high mortality
- low consumption shares
- extreme inequality

Welfare and Income, Brazil and S. Africa

				Decomposition				
	λ	Income	Log Ratio	Life Exp.	C/Y	Leis.	Cons. Ineq.	Leis. Ineq
U.S.	100.0	100.0	.000	.000	.000	.000	.000	.000
				77.4	.854	834	.539	1082
Mexico	22.0	28.6	-.262	-.149	-.011	-.010	-.088	-.005
				74.2	.844	862	.622	1092
Russia	21.1	37.0	-.563	-.480	-.130	.035	-.021	.032
				67.1	.743	736	.498	1023
Brazil	11.2	17.2	-.425	-.229	-.002	.005	-.204	.006
				71.2	.835	807	.713	1039
S. Africa	7.7	16.0	-.738	-.521	.036	.054	-.302	-.006
				60.9	.852	623	.850	1079

Welfare and Income, China and India

				Decomposition				
	λ	Income	Log Ratio	Life Exp.	C/Y	Leis.	Cons. Ineq.	Leis. Ineq
U.S.	100.0	100.0	.000	.000	.000	.000	.000	.000
				77.4	.854	834	.539	1082
China	6.4	10.1	-.458	-.163	-.261	-.016	-.004	-.014
				71.7	.647	873	.503	1093
Indo.	5.1	7.8	-.425	-.318	-.098	-.001	.032	-.041
				67.2	.774	836	.443	1170
India	3.3	5.6	-.528	-.407	-.120	-.019	.046	-.028
				62.8	.764	876	.428	1132
Malawi	1.0	1.3	-.249	-.326	.092	-.020	-.024	.028
				50.4	.920	867	.534	991

Welfare Growth

Rather than comparing levels to U.S., compare a country today with itself in the 1980s $\Rightarrow$ welfare growth.

Key Point 4: Growth rates, 1980s–2000s

- Welfare: 3.1%
- Income: 2.1%

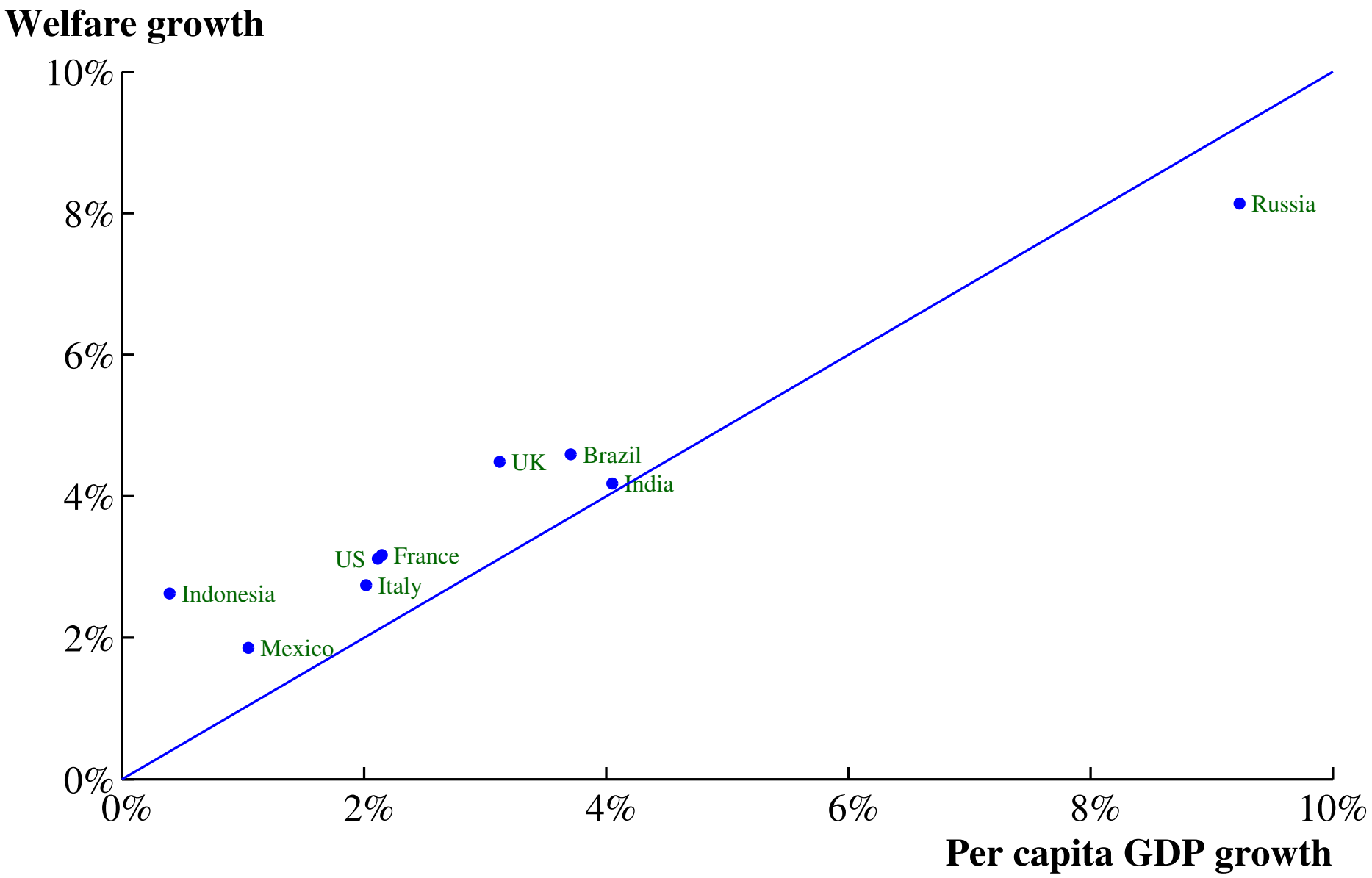
Life expectancy adds $\approx 1.0\%$, except in Africa (later)

At 2%, incomes double every 35 years, 7-fold over a century

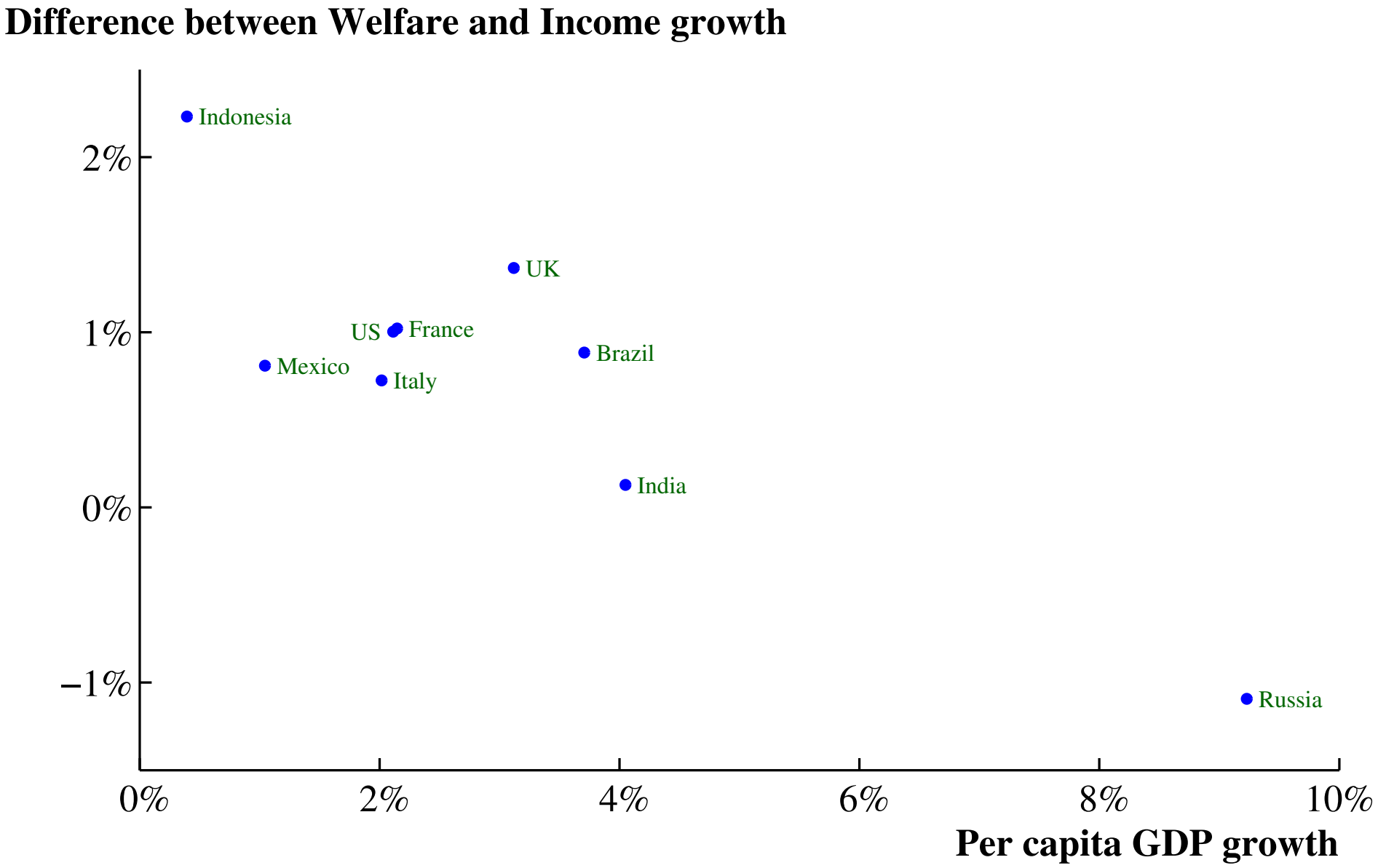
At 3%, welfare doubles every 24 years, 20-fold over a century

Growth is 50% faster because of declining mortality.

Welfare, Income Growth 1980s–2000s Correlated .97



Welfare vs. Income Growth, 1980s–2000s



Welfare vs. Income Growth

				Decomposition				
	λ	Inc.	Diff	Life Exp.	c/y	Leis.	Cons. Ineq.	Leis. Ineq.
U.K.	4.41	3.12	1.29	1.13	0.23	-0.01	-0.11	0.05
				75.4,78.7	.780,.818	577,581	.395,.450	856,829
India	3.98	4.05	-0.07	1.03	-1.11	0.04	-0.06	0.02
				57.6,62.8	.958,.750	906,882	.410,.420	1144,1133
France	3.11	2.15	0.97	1.00	0.01	-0.05	-0.07	0.07
				77.1,80.1	.767,.768	477,527	.385,.417	791,743
U.S.	3.07	2.11	0.95	0.86	0.36	-0.10	-0.08	-0.08
				75.0,77.4	.786,.850	773,839	.511,.539	1044,1084
Italy	2.68	2.02	0.67	1.28	-0.12	-0.17	-0.09	-0.22
				76.6,80.7	.714,.696	406,572	.382,.414	780,902
Indo.	2.54	0.39	2.15	1.33	0.76	0.18	-0.11	-0.00
				62.3,67.2	.702,.774	906,842	.420,.443	1176,1177
Mexico	1.81	1.05	0.76	1.03	0.11	-0.23	-0.01	-0.14
				70.8,74.2	.818,.838	705,861	.657,.619	1023,1093
Mean	3.09	2.13	0.96	1.09	0.03	-0.05	-0.08	-0.04

Results for 159 Countries

Overview of results for a broad set of countries

- Public-use multi-country data sets
  - Penn World Tables, World Bank, World Income Inequality Database
- Missing data replaced by U.S. values (zeroing out any difference)
  - Hours worked per person outside the rich countries
  - Have inequality measures for 117 countries
- Validation check: comparison of 13 countries w/ both
  - Correlation of welfare levels: 0.999
  - Average log deviation: 0.0007
  - Mean absolute log deviation: 0.067
- Very supportive of the micro reults.
  - But many more countries...

Summary Statistics for 2007, 159 Countries

				Decomposition			
	λ	Income	Log Ratio	Life Exp.	C/Y	Leis.	Cons. Ineq.
U.S.	100.0	100.0	.000	.000	.000	.000	.000
W. Europe	81.3	73.4	.103	.129	-.132	.028	.077
E. Europe	23.7	32.6	-.325	-.341	-.057	.012	.061
L. Amer.	14.8	20.8	-.363	-.148	-.067	.008	-.156
Asia	9.4	14.1	-.554	-.193	-.281	-.008	-.071
SS Africa	2.3	4.3	-.418	-.380	.012	.044	-.095

Some examples in 2007...

				Decomposition			
	λ	Income	Log Ratio	Life Exp.	C/Y	Leis.	Cons. Ineq.
United States	100.0	100.0	0.000	0.000	0.000	0.000	-0.000
				77.8	0.845	836	0.658
Netherlands	85.6	84.2	0.017	0.126	-0.245	0.034	0.101
				80.1	0.661	732	0.481
Norway	80.4	112.8	-0.339	0.141	-0.598	0.019	0.100
				80.4	0.464	780	0.483
Ireland	69.4	96.4	-0.329	0.065	-0.454	-0.022	0.082
				79.0	0.536	896	0.519
Singapore	56.2	117.1	-0.734	0.132	-0.685	-0.180	0.000
				80.4	0.426	1251	0.658
South Africa	4.9	17.4	-1.271	-0.852	-0.053	0.061	-0.427
				51.0	0.801	636	1.135
Botswana	4.6	25.1	-1.691	-0.776	-0.574	-0.008	-0.333
				52.1	0.476	859	1.048

Welfare growth summary statistics, 1980–2007 (N=134)

				Decomposition			
	λ	Income	Differ-ence	Life Exp.	C/Y	Leisure	Cons. Ineq.
Asia	4.04	4.33	-0.29	0.71	-0.78	-0.13	-0.09
W. Europe	3.30	2.29	1.01	1.22	-0.21	0.02	-0.02
U.S.	3.08	2.06	1.01	0.89	0.36	-0.08	-0.15
L. America	2.95	1.61	1.34	1.24	-0.02	-0.13	0.25
SS Africa	0.51	0.19	0.32	0.23	0.11	-0.03	0.02

Welfare growth examples, 1980–2007

				Decomposition			
	λ	Inc.	Diff	Life Exp.	C/Y	Leisure	Cons. Ineq.
S. Korea	7.96	6.39	1.56	2.12	-0.31	-0.25	0.00
				65.8,79.3	.688,.633	970,1125	.531,.531
China	4.80	5.87	-1.07	0.45	-1.29	-0.23	0.00
				67.0,72.6	.778,.549	848,1009	.863,.863
Japan	3.90	2.12	1.78	1.14	0.47	0.24	-0.07
				76.1,82.5	0.635,.721	1063, 907	.542,.577
Botswana	3.60	6.27	-2.67	-0.99	-1.46	-0.22	0.00
				60.5,52.1	.789,.532	674, 859	1.048,1.048
France	3.21	1.57	1.64	1.34	0.04	0.11	0.15
				74.1,80.8	.777,.785	723, 613	.566,.490
Nethrlnds	2.56	2.32	0.24	0.85	-0.56	-0.03	-0.02
				75.7,80.1	.777,.668	705,732	.489,.501

Conclusions

- Income and welfare are highly correlated in both levels and growth rates.
- Nevertheless, differences between income and welfare are often economically important:
  - Western Europe looks much closer to U.S. living standards.
  - Most other countries are further behind, primarily due to lower life expectancy.
  - Growth is 50% faster than we thought, largely because of significant declines in mortality: 3% versus 2%