Growth and Development: Measurement

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Lecture Notes for PhD Growth and Development (EC8510)

Measuring Development

- ▶ Development = to transition from one state to another, usually in a normatively desirable direction.

- ▶ Two notions:

  - ▶ A gap between reality and potential

  - ▶ A dynamic process that (hopefully) translates potential into reality

- ▶ Economic development should be judged in terms of what it does to the lives of human beings and so the enhancement of living conditions (Sen, 1988).

The Importance of Data

▶ We don't need data to realize that there are large differences in living standards across/within countries.

▶ But we do need data if we want to systematically understand differences in living standards.

▶ The minimum requirement is data that allows us to compare real living standards across countries and over time ... easier said than done.

Per Capita Income

- ▶ The most common indicator of development is per capita income and the rate of its growth.

- ▶ The creation of the Penn World Tables (PWT) was revolutionary.

- ▶ Provided the first real opportunity to systematically compare real living standards across countries and over time with broad coverage.

THE ECONOMIC JOURNAL

JUNE 1978

The Economic Journal, **88** *(June 1978), 215–242*
Printed in Great Britain

REAL GDP *PER CAPITA* FOR MORE THAN
ONE HUNDRED COUNTRIES*

Kravis, Heston, and Summers (1978)

The Big Challenge

▶ Measuring nominal GDP in a given country at a given time is hard.

▶ Measures of *real* income, accounting for differences in the cost of living, are better measures of differences in living standards but much harder to produce.

▶ Producing measures of real GDP across countries at a given point in time is especially difficult.

▶ Traditional strategy: use exchange rates to convert nominal GDPs into a common currency and use this as a measure of relative living standards.

  ▶ Thoughts?

The Big Challenge

▶ Exchange rates deal with the units problem, but what about non-tradables?

▶ The purchasing power of \$1 varies substantially across countries.

▶ Measuring purchasing power across countries is incredibly difficult.

  ▶ Standard approach is to use a "common basket". Does one exist?

  ▶ "Advanced economy" items can be very expensive in low income countries, leading one to conclude that purchasing power is very low.

  ▶ The ICP update purchasing power comparisons every few years. Can have a large effect on quantitative assessments of differences in living standards.

PPP Bias

▶ PPP bias stems from two problems that are well documented in the price index literature: the quality bias and the substitution bias. Is it sizable? Unfortunately, the answer is likely yes.

▶ Almas (2012)

  ▶ Can we get PPPs from alternative data sources (e.g., consumer expenditure surveys) without price information?

▶ Argente, Hsieh and Lee (2023)

  ▶ PPPs are systematically biased due to many reasons. How large is each bias?

Almas (2012): Measuring PPP Bias using Engel Curves

▶ **Basic idea:** if two households in different countries have the same PPP adjusted income and the same demographic characteristics (the same age and number of children and adults), any difference in the budget share for food can be attributed to PPP bias.

▶ Why? Engel curve for food is log-linear and stable, both over time and across societies.

▶ Hamilton (2001) developed this methodology to estimate CPI bias in the United States.

Almas (2012): Measuring PPP Bias using Engel Curves

▶ P_j, the composite price of consumption in country j, can be expressed as

$$P_j = P'_j \times E_j$$

where P'_j is the biased macro price of consumption given in the PWT and E_j is the PPP bias for this country.

▶ The Engel curve can be expressed as

$$m_{h,r,j} = a + b(\ln y_{h,r,j} - \ln P'_j) + \gamma(\ln P^f_{r,j} - \ln P^n_{r,j}) + \theta X_{h,r,j} + \sum_{j=1}^{N} d_j D_j + \epsilon_{h,r,j}$$

where D_j is the country dummy. The country dummy coefficient, d_j, is a function of the PPP bias, E_j, and the coefficient for the logarithm of household income, b:

$$d_j = -b \ln E_j, \text{ therefore, } E_j = \exp\left(-\frac{d_j}{b}\right)$$

Almas (2012): Measuring PPP Bias using Engel Curves

TABLE 3—THREE DIFFERENT INCOME MEASURES

	Y^{PWT}	Y^{EC}	Y^{EX}
UK	15,088	15,088	15,088
Spain	11,935	11,507	10,162
Hungary	5,651	3,363	2,780
Brazil	4,818	3,899	3,235
Bulgaria	3,027	1,073	1,106
Peru	2,839	818	1,575
Azerbaijan	1,739	939	303
Côte D'Ivoire	1,471	491	634
Nepal	829	211	151
Tanzania	372	97	111

Note: The table shows the income measured by PWT, EC incomes, and EX incomes for the ten base countries.

Engel Elsewhere

▶ We can use Engel's law in many other applications.

1. Nakamura, Steinsson, and Liu (2016) revisited China's official inflation statistics.

2. Hurst, Li, and Pugsley (2014) quantified the extent to which the self-employed systematically underreport their income in U.S. household surveys.

3. Atkin, Faber, Fally, and Gonzalez-Navarro (2024) estimated inflation and welfare changes in rural India between 1987 and 2000 at each point of the income distribution.

Argente, Hsieh, and Lee (2023): Direct Evidence

▶ Measurement is hard: Issues of imputation, sampling, quality, and variety.

▶ AHL (2023) quantify potential biases in the ICP using a new decomposition framework to get at these components.

▶ They do this using Nielsen scanner data for US and Mexico.

  ▶ ICP overstates Mexican prices due to imputation, sampling, and variety bias

  ▶ ICP understates Mexican prices due to quality bias

Open Questions

▶ Are poor countries cheap for everyone?

  ▶ See Handbury and Weinstein (2014) and Handbury (2021) for cities in the US.

  ▶ Distributional CPI for the US by Jaravel (2024)

▶ What are the causes and consequences of price differences across countries?

  ▶ High price of cement in Africa comes from higher marginal costs and higher markups
    (Leone et al., 2024)

▶ How does informality and household production shape our understanding of cost of
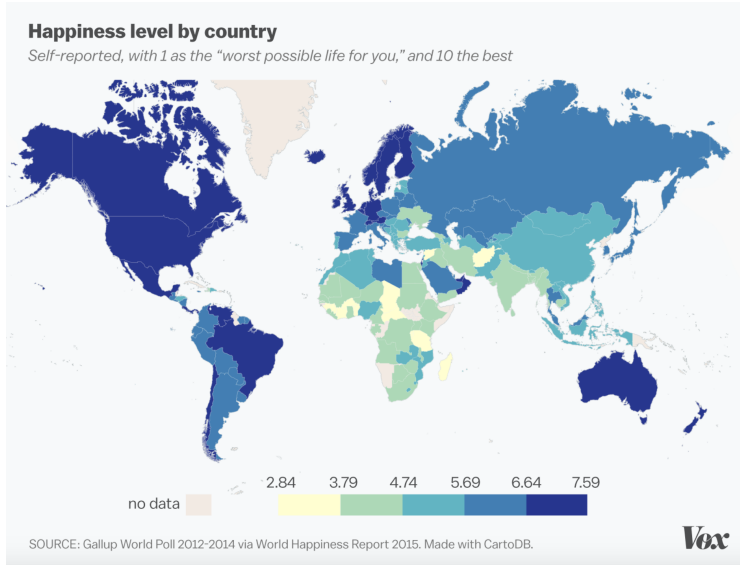living?

Per Capita Income

- Despite its popularity it has many limitations as a measure of the human condition.

  - For one, it only captures the value of *private* goods and services that are bought and sold in the market

  - Important elements that determine quality of life are not included.
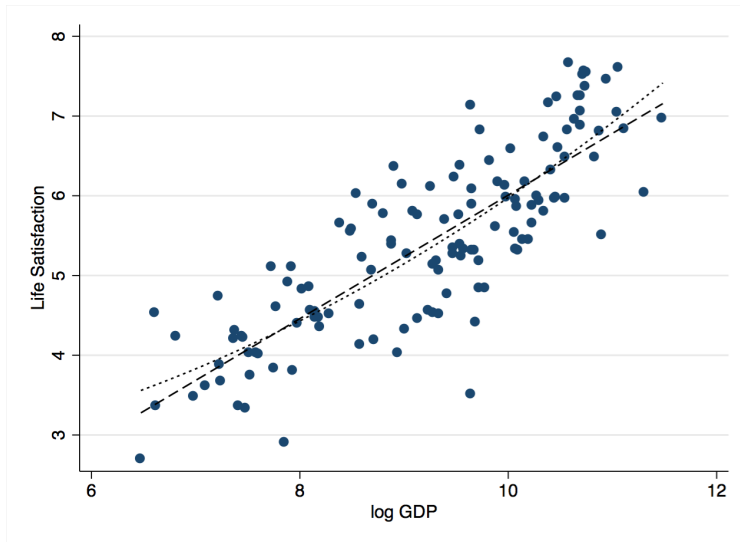
Happiness and Life Satisfaction

▶ What about indicators like life satisfaction and happiness?

Happiness Level by Country

Happiness level by country
Self-reported, with 1 as the "worst possible life for you," and 10 the best

no data — 2.84 — 3.79 — 4.74 — 5.69 — 6.64 — 7.59

SOURCE: Gallup World Poll 2012-2014 via World Happiness Report 2015. Made with CartoDB.

Vox

Happiness vs. GDP per Capita

Happiness and Life Satisfaction

- Issues?

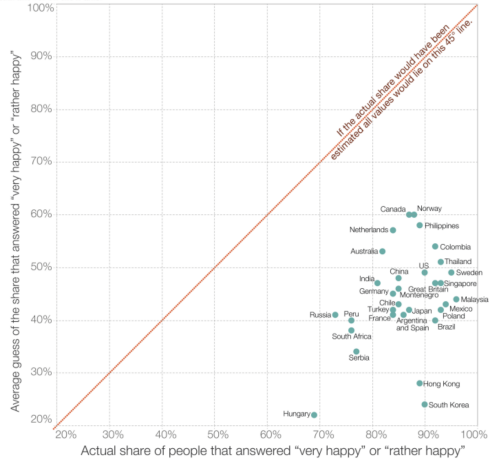# Happiness and Life Satisfaction

- ▶ Issues?

  - ▶ These indicators have no objective yardstick

  - ▶ They depend entirely on individual perception and social influence

  - ▶ Happiness is not a substitute for Poverty eradication.

  - ▶ People normalize and so they are not much help when making comparisons across space or time.

Happiness Perceptions

In every country people think that others are less happy than they themselves say
People were asked the following question "When asked in a survey, what percentage of people do you think said that, taking all things together, they are very happy or rather happy?". The average answer is plotted on the y-axis against the actual answer on the x-axis.

Our World in Data

If the actual share would have been estimated all values would lie on this 45° line.

Y-axis: Average guess of the share that answered "very happy" or "rather happy"
X-axis: Actual share of people that answered "very happy" or "rather happy"

The Human Development Index

▶ Amartya Sen's capability theory – development should expand people's "budget sets", broadly defined as things they are able to do.

▶ The goal of development becomes the gradual enhancement of an individual's capability:

 ▶ An individual's well-being cannot be determined by policies or cardinally measured

  ▶ It's hard to evaluate what people do with their budget and whether it makes them happy.

 ▶ However, enhancing someone's capability will enable them to realize their goals.

The Human Development Index

▶ Formulated by Mahbub ul Haq and Amartya Sen and included in the UN Development Report since 1990.

▶ It is an average of three different indices – per capita income, the mortality rate, and an index of education.

▶ The third used to be determined by the rate of adult literacy and enrollment in/years of schooling.

▶ Education and health do not merely contribute to the rise of national income, they are also important indicators of quality of life.

The Human Development Index
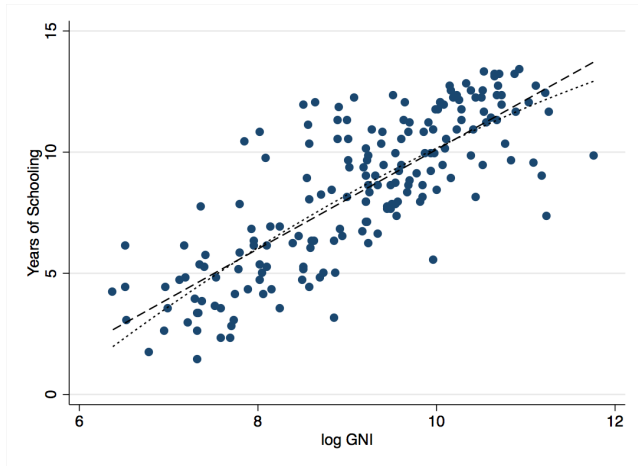
The Human Development Index
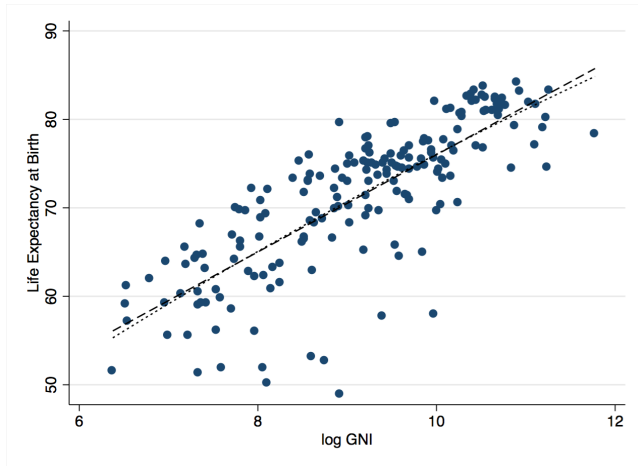
The Human Development Index

- Capability cannot be determined by education and health alone

- Capability depends considerably on the rights that individuals are permitted.

- Violations may include:

    - curbing freedom of expression

    - discrimination

- Development indices do not tend to take these considerations into account.

Inequality

▶ Per capita income fails to capture inequality among sections of the population.

▶ Economists tend to be more concerned about inequality of opportunity.

  ▶ Unequal societies can limit individuals from reaching their full potential.

  ▶ Too much equality can limit incentives.

▶ There are reasons to be concerned about inequality as an end in itself.

Inequality

- Generally, inequality is a relative indicator while poverty is an absolute one.

  - Absolute poverty is objectionable by most welfare criteria.

  - The importance of inequality depends on the social welfare function.

- What if there is no absolute poverty. Is inequality still a bad thing?

Other Issues

▶ A few extra considerations:

1) **Environment:** When we calculate national income, we take the capital required to generate this income and allow for depreciation. What about the depreciation of natural resources and the environment?

2) **Discrimination:** We should take into account the relative development and growth rate of different groups

3) **Risk:** Income indicators do not capture fluctuations in income patterns. Per capita income may be above the poverty line, but more income uncertainty should be valued less.

Jones and Klenow (2016)

▶ Present a welfare metric based on economic & political science theory

▶ Measure yearly welfare for many countries and years

▶ Based on work of John Rawls

▶ Goal: to provide insights into how well GDP per capita performs as a welfare measure

The Veil of Ignorance Experiment

▶ Say we are all risk averse

▶ One of us will be born "unproductive" and have low consumption.

▶ The rest will be productive and have high consumption.

▶ We are all "behind the veil of ignorance" and don't know who will be who.

Veil of Ignorance Experiment

▶ Which would you choose:

1) Social contract: we commit behind the veil to help the person that turns out to be unproductive ex post.

2) Autarky: we let the uncertainy realize and bad luck to whoever turns out to be unproductive.

Veil of Ignorance Experiment

- **Result:** As long as people are risk-averse, they are strictly better off under the social contract.

- Thus, Rawls argues that we should hold people to this contract *ex post*.

- That is, we should enact policies that redistribute wealth to the neediest.

Jones & Klenow (2016)

- ▶ Not arguing for redistributive policies.

- ▶ Instead asking that a representative individual for each country go behind the veil of ignorance.

- ▶ Will live entire life as a random individual in some country

Expected Lifetime Utility

$$U = E\left[\sum_{a=1}^{100} \beta^a \cdot u(C_a, \ell_a) \cdot S(a)\right]$$

- C_a: Consumption at age a

- ℓ_a: Leisure at age a

- $S(a)$: Probability of survival to age a

- β^a: Discount factor (less than one)

Jones-Klenow Welfare Metric

▶ **Choice one:** live in country j, born as one randomly selected person in j

  ▶ Face $j's$ survival rates; age of death is random

  ▶ Draw randomly from j's consumption and leisure distribution

▶ **Choice two:** Move to the U.S., live as one randomly selected person, get fraction λ time consumption.

▶ Welfare of j is defined as the λ that makes "Rawls" indifferent between **Choice one** and **Choice two**.

Jones-Klenow Welfare Metric

If,

$$E\left[\sum_{a=1}^{100} \beta^a \cdot u(C_a, \ell_a) \cdot S(a)\right] = E\left[\sum_{a=1}^{100} \beta^a \cdot u(\lambda \cdot C_a^{US}, \ell_a^{US}) \cdot S^{US}(a)\right]$$

For some number λ, then λ is the welfare of country j.

Operationalizing the Welfare Metric

- ► Need distribution of consumption and leisure

    - ► Use household surveys for 13 countries

- ► Need survival rates by age,

    - ► Take from UN statistics

- ► Need functional forms for utility function

- ► Need to calibrate utility function

Utility Function

$$u(C_a^j, \ell_a^j) = u^* + \log(C_a^j) + \log(\ell_a^j)$$

▶ Key parameter is u^*

▶ u^* is the fixed utility value just for being alive.

▶ What is the value of staying alive one extra year?

▶ "Value of Statistical Life" (VSL)

▶ In the US, the expected value of remaining life for a 40 year old is estimated to be around \$6 million dollars
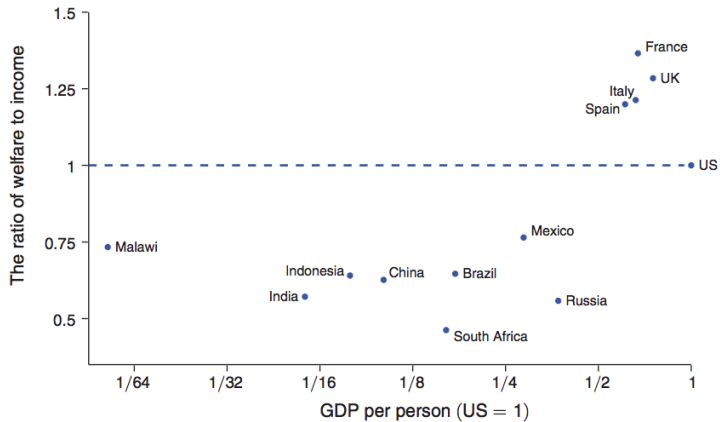
Welfare and GDP per capita

Panel A. Welfare and income are highly correlated at 0.98
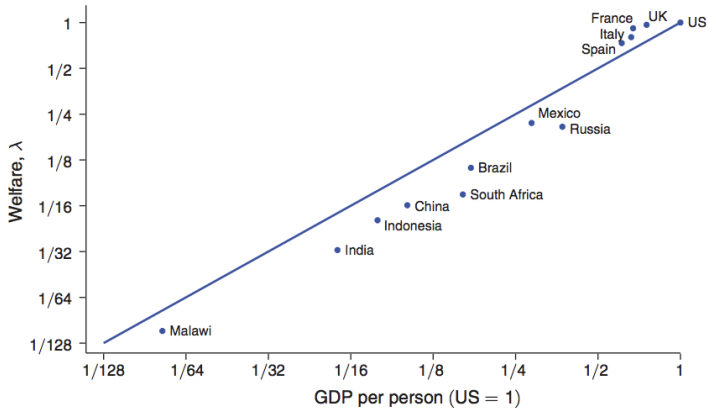
Welfare and GDP per capita

Panel B. But this masks substantial variation in the ratio of λ to GDP per capita

U.S. versus Europe

	Welfare λ	Income	log ratio	Decomposition				
				Life exp.	C/Y	Leisure	Cons. ineq.	Leis. ineq.
US	100.0	100.0	0.000	0.000	0.000	0.000	0.000	0.000
				77.4	*0.897*	*877*	*0.538*	*1,091*
UK	96.6	75.2	0.250	0.086	−0.143	0.073	0.136	0.097
				78.7	*0.823*	*579*	*0.445*	*826*
France	91.8	67.2	0.312	0.155	−0.152	0.083	0.102	0.124
				80.1	*0.790*	*535*	*0.422*	*747*
Italy	80.2	66.1	0.193	0.182	−0.228	0.078	0.086	0.075
				80.7	*0.720*	*578*	*0.421*	*905*
Spain	73.3	61.1	0.182	0.133	−0.111	0.070	0.017	0.073
				79.1	*0.786*	*619*	*0.541*	*904*

U.S. versus Developing Countries

	Welfare λ	Income	log ratio	Life exp.	C/Y	Leisure	Cons. ineq.	Leis. ineq.
						Decomposition		
Mexico	21.9	28.6	−0.268	−0.156	−0.021	−0.010	−0.076	−0.005
				74.2	0.879	906	0.634	1,100
Russia	20.7	37.0	−0.583	−0.501	−0.248	0.035	0.098	0.032
				67.1	0.733	753	0.489	1,027
Brazil	11.1	17.2	−0.436	−0.242	0.004	0.005	−0.209	0.006
				71.2	0.872	831	0.724	1,046
S. Africa	7.4	16.0	−0.771	−0.555	0.018	0.054	−0.283	−0.006
				60.9	0.887	650	0.864	1,093
China	6.3	10.1	−0.468	−0.174	−0.311	−0.016	0.048	−0.014
				71.7	0.658	888	0.508	1,093
Indonesia	5.0	7.8	−0.445	−0.340	−0.178	−0.001	0.114	−0.041
				67.2	0.779	883	0.445	1,178
India	3.2	5.6	−0.559	−0.440	−0.019	0.085	0.085	−0.028
				62.8	0.785	918	0.438	1,143
Malawi	0.9	1.3	−0.310	−0.389	0.012	−0.020	0.058	0.028
				50.4	0.923	934	0.533	997

Conclusions

▶ GDP per capita is highly correlated with "welfare"

▶ Europe has low GDP per capita relative to the US, but comparable welfare levels

    ▶ More leisure, less inequality, higher life expectancy

▶ Developing countries have lower welfare than is suggested by GDP per capita

    ▶ lower life expectancy, (in some cases) higher inequality
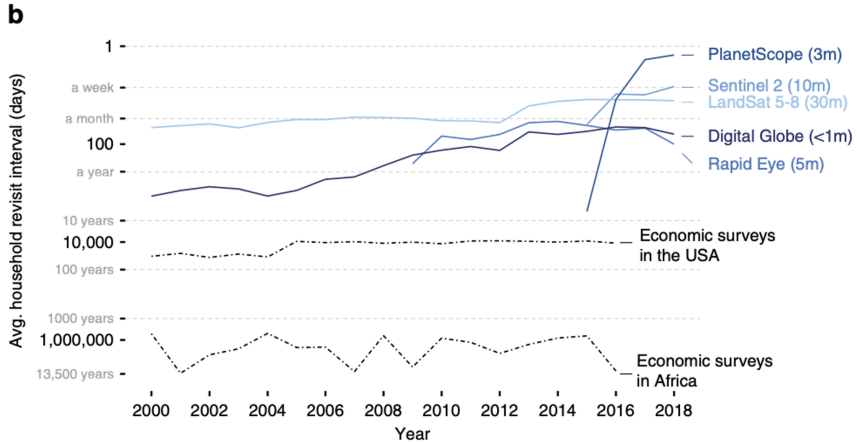
Frontiers in Measuring Development

Cumulative satellite launches

Data from UCS database
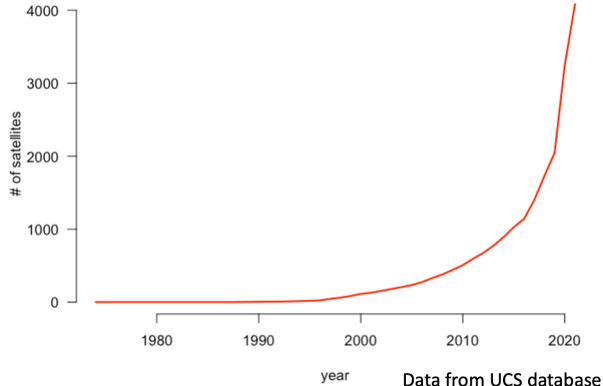
There are an immense number of new satellites...

Frontiers in Measuring Development

... providing immense amounts of new data.

There has been an explosion of research using remote sensing data in recent years

- Agriculture
- Economic activity/livelihoods
- Land use change
- Urbanization
- Population measurement
- Mobility/migration
- Air pollution, emissions
- Deforestation
- Weather
- ...

Remote Sensing Data

- ▶ The Benefits of Remote-Sensing Data

    1) Access to information difficult to obtain by other means

    2) Unusually high spatial resolution

    3) Wide geographic coverage

    4) Publicly available!

- ▶ Things to worry about:

    1) Measurement error

    1) Endogeneity

- ▶ See Donaldson and Storeygard (2016) and Burke et al. (2021) for a primer in remote sensing data for economists.