

Potatoes: Nutrition, productivity and population growth

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14.73, Challenges of World Poverty MIT

Lecture 4

Population Growth: What does it have to do with potatoes?

- ▶ Malthus (writing in the XIX century) believed that population growth had an inherent limit: phases of rapid population would necessarily be followed by widespread famine, which would bring back the population in check.
- ▶ He was writing in the midst of a rapid population growth, which accelerated in the XVIII century, and would not actually stop for a while [▶ Graph](#)
- ▶ Signs that this is due to improved nutrition: Improvement in heights by about 10 centimeters over the same period! Potatoes is a prime candidate, as it was started to be cultivated as a main crop towards the end of the XVII century.
- ▶ However, potatoes may not be the *cause* of population growth. They may have been adopted because population was growing, or simultaneously with another invention.

Finding out whether potatoes lead to population growth: The Strategy

- ▶ Two factors determine whether or not you can grow potatoes:
 - ▶ Time: Potatoes needs to be discovered (post 1700 vs pre 1700)
 - ▶ Suitability: Potatoes cannot be grown everywhere [▶ Map](#): They demand a cool climate.
- ▶ Taken in isolation, these factors are not enough to assess the specific impact of potatoes
 - ▶ Time: other things have happen before/after 1700
 - ▶ Geography: the places that were good for potatoes may be very different
- ▶ Idea: combine them together

Difference in differences

- ▶ did the population (and urban share) of countries *grew faster* after the introduction of potatoes if they were more suitable for potatoes than if they were not.
- ▶ It seems to be the case: see [▶ Graph](#)
- ▶ the faster increase starts in the century after introduction [▶ Graph](#)
- ▶ Assumption: in the absence of potatoes, countries would have continued on their normal course.
- ▶ In that case, this faster increase must be due to potatoes

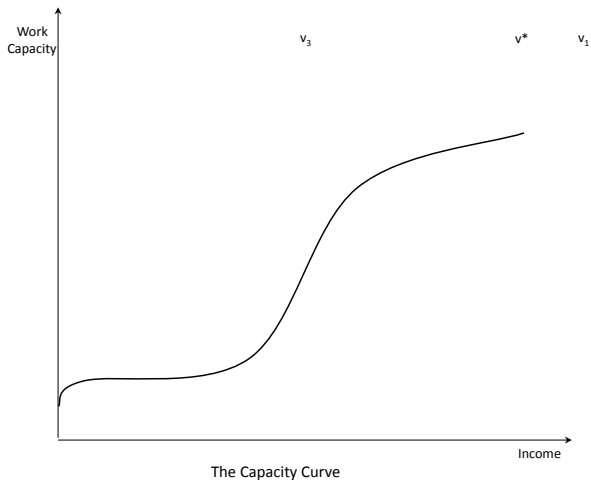
Robustness

- ▶ Are these results robust to a number of concerns?
 - ▶ Europe is suitable for potatoes, but also share a common history: Control for roman empire*post
 - ▶ Rugged terrain and elevation: Control for rugged terrain*post and elevation*post
 - ▶ Recovery from Black Death (which killed 30% of people around 1400)
 - ▶ May be potatoes country have better access to trade: control for distance to coast*post
 - ▶ Non-potatoes country are in Africa: control for slave trade.

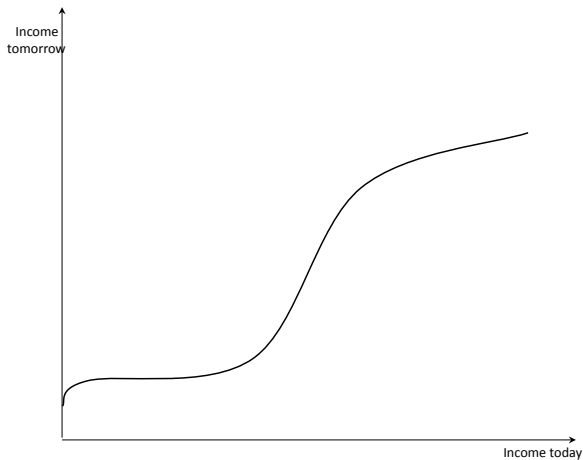
The functional impact of Poverty: Some elementary human biology

- ▶ How can we explain these results?
- ▶ Remember Pak Solhin's problem with finding a job, after the increase in fertilizer and food prices
- ▶ He could not accept a lower salary to be an agricultural worker, because at the lower price, he would not be able to work enough to justify the salary.
- ▶ The first calories we are consuming must be used to feed our body
- ▶ Only after that can we put the body to use
- ▶ Imagine that every morning, Pak Solhin eats the biggest meal he can afford, then works all day to harvest a field, and is paid by the piece at night. He saves the money till the next morning where he eats again.
- ▶ This creates a relationship between income in day 1 and income in day 2

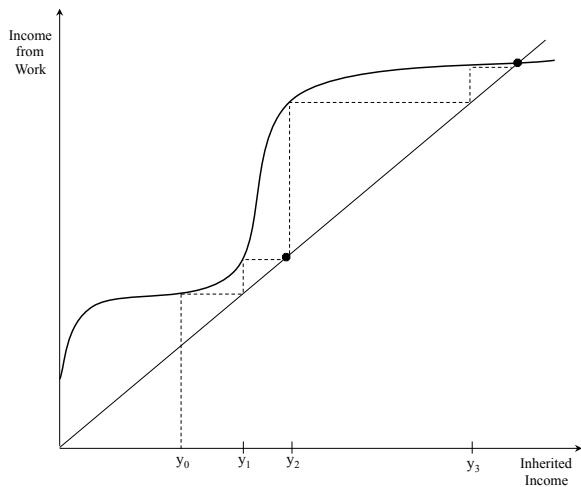
The Capacity curve



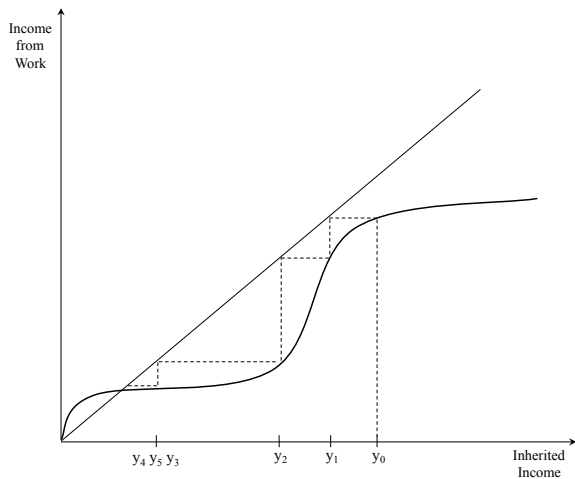
The relationship between income in day 1 and income in day 2



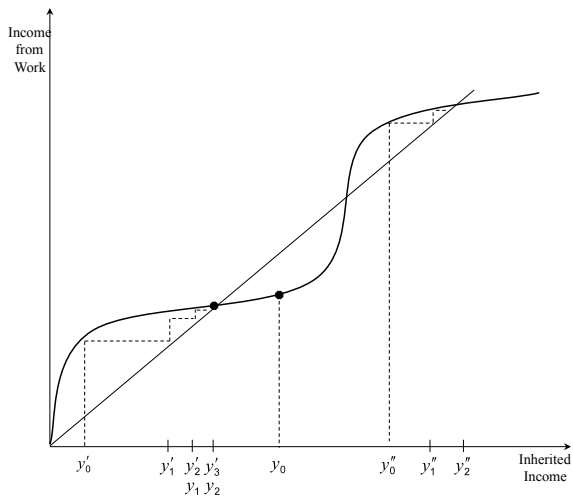
Case 1: no Poverty trap



Case 2: Immiseration



Case 3: Poverty Trap



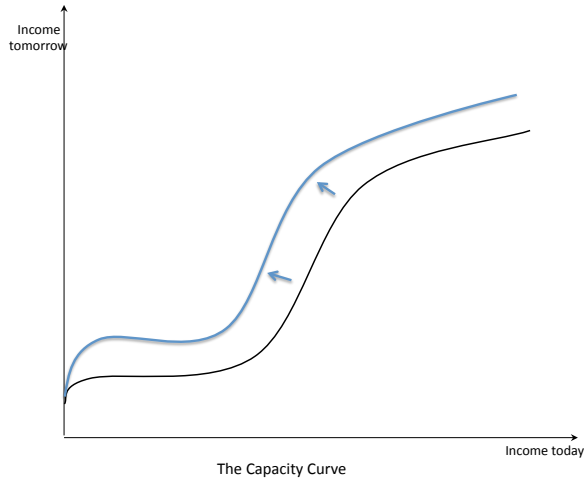
The nutrition-based poverty trap

- ▶ This formalizes the argument that was present in the Sachs-Jolie video: a country that has low land productivity may be caught in a poverty trap
- ▶ People who have no wealth also may have no labor income: individual-level poverty trap
- ▶ Role of inequality: there may be nobody caught in a poverty trap in a more equal country
- ▶ ... or the opposite may be true

What do potatoes have to do with it?

- ▶ Potatoes have a number of great characteristics
 - ▶ They are very nutritious
 - ▶ The caloric production per acre is high
 - ▶ They can be used in alternance with regular crop
- ▶ What does it do the capacity curve?
- ▶ It shifts it up: the poverty trap may disappear, or the number of people who are in the poverty trap equilibrium may disappear

capacity and potatoes

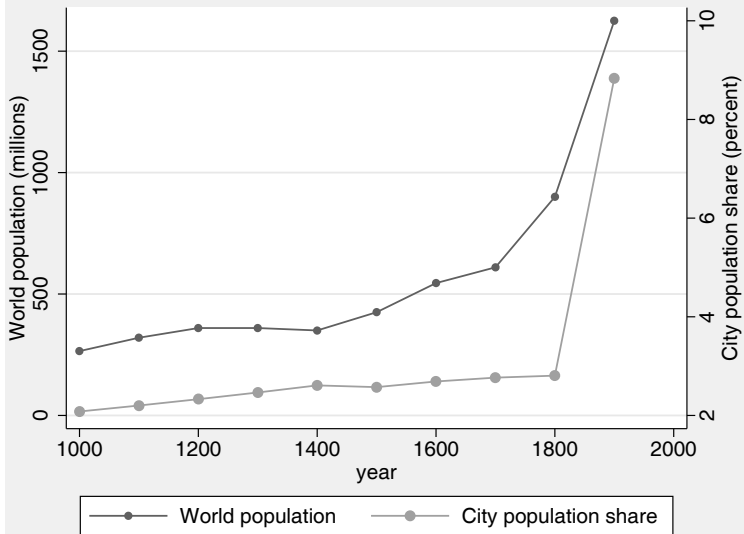


Is the nutrition based poverty trap still a problem today?

- ▶ Now that we have potatoes (and corn, and tomatoes), is nutrition still a possible source of poverty trap?
- ▶ Importance of agricultural technology: the green revolution has changed India
- ▶ A new green revolution for Africa ? (stay tuned)
- ▶ At today's level of nutrition, do we still see people caught in nutrition-based poverty trap?
- ▶ Relationship between calorie consumption and productivity on the farm in Sierra Leone: Steep, but no "S-shape" which would suggest a poverty trap. [▶ graph](#)
- ▶ May be nutrition-based poverty traps based on calorie only is less relevant for adults today than it was at the time of potatoes.

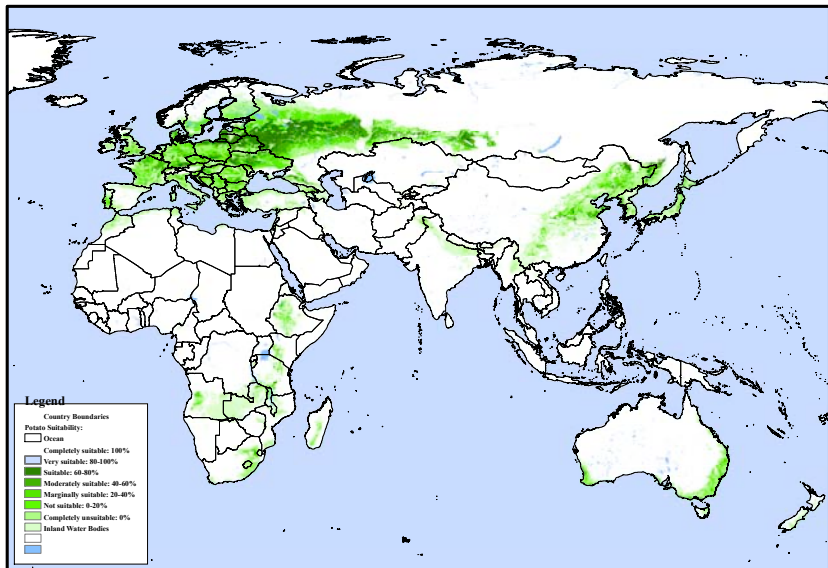
Is the nutrition based poverty trap still a problem today?

- ▶ However, there are other important nutrients which may have long term impacts
 - ▶ Iron: 1 billion people suffer from Iron-Deficiency anemia (WHO estimate). Anemia causes weakness, increase susceptibility to disease, low birth weight.
 - ▶ Iodine: Africa has little iodine in the rock. Iodine-deficiency causes goitres and reduced cognitive capacities
- ▶ In-Utero and early childhood nutrition
 - ▶ “The Barker Hypothesis” (after a doctor named Barker)
 - ▶ Those in-utero during famines (e.g. the famine in China) have much worst long term outcomes (even though they have survived, so they should be stronger!!)
 - ▶ Iodine supplementation of pregnant women in Tanzania led to increased performance in school for children whose mother benefitted from it while they were in-utero



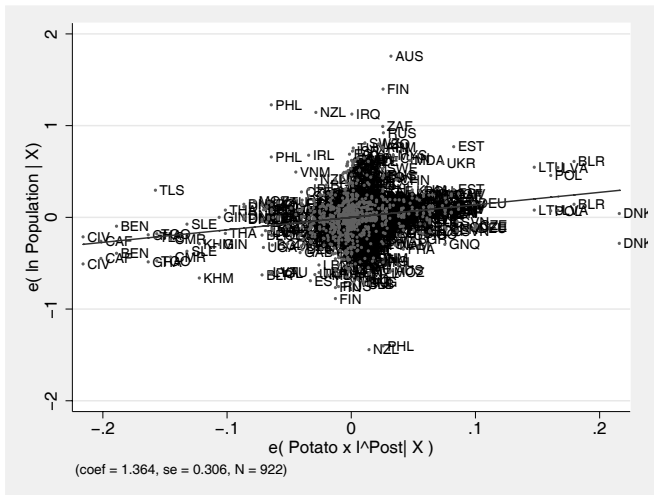
Sources: See text.

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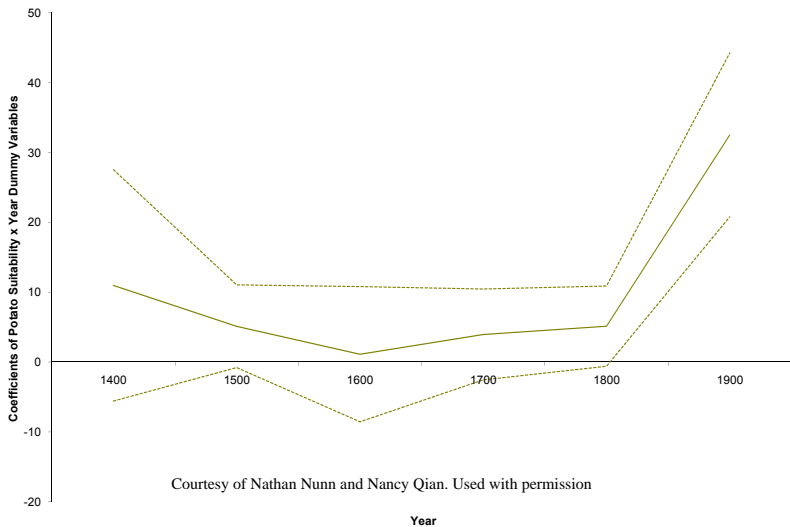
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Population increase and suitability for potatoes



(a) Dep var: In population

Population increase and suitability for potatoes, by century



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$$(a) \text{Potato}_i \times I_t^j$$

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