Discussion of "Robots, Trade and Luddism" by Costinot and Werning

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Assumptions

- Preferences: $U\left(\left\{c_i\right\}, n\left(\theta\right)\right)$ where θ is skill level
  - Common preferences, but different incomes due to different skills
- Technologies: $G\left(\left\{y_i\right\}, \left\{n\left(\theta\right)\right\}\right) \leq 0$ and $G^*\left(\left\{y_i^*\right\}; \phi\right) \leq 0$.
  - y_i and y_i^* are perfect substitutes, but can be taxed separately
- Government:
  - policy tools:
    - ★ non-linear income tax
    - ★ linear taxes/subsidies on production by new technologies
  - maximizes welfare function $W\left(\left\{U\left(\theta\right)\right\}\right)$

Envelope result

- Let $V(\phi) = \max W(\{U(\theta)\})$ subject to consumer/firm maximization, market clearing, and balanced budget. Then,

$$\frac{dV}{d\phi} = -\gamma \frac{\partial G^*}{\partial \phi}$$

  where $\gamma > 0$

- What does this mean? Check whether previous consumption allocation is still available. If so, we should welcome technological change.

- What does it require?
  - Technological change must ...
    - ... be small and exogenous,
    - ... not affect preferences and/or old technologies *directly* (New externalities?)
  - The government is maximizing the social welfare function

What is an envelope result?

- Define value function: $V\left(x\left(\phi\right),\phi\right)=\max_{<x>}U\left(x\right)$ subject to $B\left(x;\phi\right)\leq 0$
- Set Lagrangian: $\mathcal{L}=U\left(x\right)-\gamma B\left(x;\phi\right)$
- Compute FOC: $U'\left(x\right)-\gamma\frac{\partial B}{\partial x}=0$
- Then, $V'\left(x\left(\phi\right),\phi\right)=\left(U'\left(x\right)-\gamma\frac{\partial B}{\partial x}\right)\frac{dx}{d\phi}-\gamma\frac{\partial B}{\partial\phi}=-\gamma\frac{\partial B}{\partial\phi}$
- The envelope result applies because we are in an optimum of the social welfare function

On the valuation of technological change

- How do governments make their choices?
  - *Preference aggregation*: Does a nice and transitive $W\left(\left\{U\left(\theta\right)\right\}\right)$ exist?
    - ★ Even if median voter theorem applies, for instance, a technological shock could change the median voter
  - *Agency problems*: Does $W\left(\left\{U\left(\theta\right)\right\}\right)$ really represent social welfare?
    - ★ Providing the right incentives to policymakers is quite difficult
- When the private sector is second-best, envelope arguments still work provided government is first-best!
  - Globalization, for instance, might ...
    - ★ ... worsen policy choices (Epifani-Gancia 2009, Broner-Ventura 2011)
    - ★ ... change political structure (Alesinaet al. 2000, Gancia et al. 2020)

Understanding optimal taxes

- This paper provides an *impressive* generalization of many results within this category that allows us to ...
  - ... better understand the connection between different, sometimes seemingly contradictory results
  - ... improve our ability to obtain quantitative estimates of optimal policy using reduced-form estimates

- Lemma 2, which encompasses the two optimal tax formulas surely contains many hidden gems. Please show more of them!
  - *First formula*: If income taxes cannot be changed, taxes on new technologies can be characterized in terms of their distributional impact
  - *Second formula:* If income taxes keep the distribution of utility constant, taxes on new technologies can be caracterized in terms of their efficiency effects

- More discussion of the role and use of formulas (descriptive vs. comparative statics). Nice example in section 6. Are more general results possible?