Discussion
Aggregate Productivity with Heterogeneous Agents

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This Paper

- ▶ This paper proposes a

  welfare-based measure of aggregate productivity with heterogeneous individuals

- ▶ Structure
    1. Lump-sum transfers
    2. Costly transfers
    3. Application: China shock

- ▶ I enjoyed diving deeply into the paper!
  And the discussions with Ariel and David over the years

- ▶ Interesting alternative to Kaldor-Hicks
    - ▶ More so with lump-sum transfers
    - ▶ Less so without

Discussion Roadmap

1. Welfare Assessments & challenges → Big Picture
   - Single Individual: $I = 1$
   - Heterogeneous Individuals: $I \geq 1$
2. Aggregate Productivity → This Paper
   - Definition
   - Example → Stylized China Shock
3. Final Comments

Welfare Assessments

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Step #1: Specify a model

Step #2: Consider a (global or marginal) change/perturbation in allocations

Technology-driven or not: e.g. AI, Tariffs, Monetary/Fiscal Policy, China shock, etc.

$$\text{status quo } (\underline{\theta}) \ \rightarrow \ \text{alternative } (\theta)$$

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WELFARE QUESTIONS

	Individual	**Aggregate**
Are people better or worse off? **Ordinal**	Easy	Ambiguous Efficiency/Redistribution
By how much? **Cardinal**	Ambiguous Unit + Experiment	**Hard** **(this paper)**

Welfare Assessments

- ▶ Why are welfare assessments so hard? <small>Paradoxes/reversals/impossibility</small>
- ▶ **Two Original Sins of Welfare Economics**

Welfare Assessments

- ▶ Why are welfare assessments so hard? Paradoxes/reversals/impossibility
- ▶ **Two Original Sins of Welfare Economics**

Sin #1 | Ordinality of Preferences |

- ▶ Utility scores lack cardinal meaning
  Many preference-preserving transformations of utilities → Same behavior
- ▶ Cardinal assessments require a <u>unit</u> → welfare numeraire

Sin #2 | Varying Marginal Utility of "Wealth" | ("income effects")

- ▶ Solved with quasi-linearity → ... but this is EFG!
- ▶ Irrelevant for marginal assessments

Single/Representative Individual

a) Ordinal assessment: $\underbrace{V^i(\underline{\theta})}_{\text{status quo}}$ vs. $\underbrace{V^i(\theta)}_{\text{alternative}}$

b) Cardinal assessment

1. Choose $\boxed{\text{unit}} \rightarrow$ welfare numeraire
2. Choose $\boxed{\text{experiment}} \rightarrow$ e.g. EV, CV, CS Marginally: EV=CV=CS

Equivalent: value at status-quo vs. Compensating: value at alternative

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▶ Example: Lucas 87 → Cost of Business Cycles

$$EV: \underbrace{\sum_t \beta^t \sum_{s^t} \pi\left(s^t\right) u\left(c_t^i\left(s^t; \underline{\theta}\right)\left(1 + \mathcal{E}^i(\theta)\right)\right)}_{\text{Status Quo (Business Cycle) + EV}} = \underbrace{\sum_t \beta^t \sum_{s^t} \pi\left(s^t\right) u\left(c_t^i\left(s^t; \theta\right)\right)}_{\text{Alternative (No Business Cycle)}}$$

$$CV: \underbrace{\sum_t \beta^t \sum_{s^t} \pi\left(s^t\right) u\left(c_t^i\left(s^t; \underline{\theta}\right)\right)}_{\text{Status Quo (Business Cycle)}} = \underbrace{\sum_t \beta^t \sum_{s^t} \pi\left(s^t\right) u\left(c_t^i\left(s^t; \theta\right)\left(1 - \mathcal{C}^i(\theta)\right)\right)}_{\text{Alternative (No Business Cycle) − CV}}$$

   1. Unit: proportional perpetual individual/aggregate consumption
      Others: date-0 consumption, consumption in booms/recessions, etc.
   2. Experiment: EV-style
      EV vs. CV may matter → Jones/Klenow 2016 AER

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Many Individuals

a) Ordinal assessment → SWF: $\mathcal{W}\left(V^1, \ldots, V^I\right) \underbrace{=}_{\text{typically}} \overbrace{\sum_i \alpha^i V^i}^{\text{utilitarian}}$

   Pareto criterion → rarely useful

   ▶ <u>Appeal</u>: Paretian + global ranking → optimal policy objective
   ▶ <u>Challenge</u>: not invariant to preference-preserving transformations

   Addressable: compute "individual weights" in Davila/Schaab JPE 2025

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   ▶ Kaldor-Hicks = (unweighted) sum of gains and losses

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▶ **Remark:** literature used to treat SWF and KH as radically different approaches
   Davila/Schaab JPE 2025 $\rightarrow$ once a welfare numeraire is chosen, marginally:

$$\boxed{\text{SWF} = \text{Kaldor-Hicks} + \text{Redistribution}}$$

Three Remarks

- **Remark #1:** KH depends on welfare numeraire (and experiment)
    1. Monetary/financial-based → partial equilibrium ($px \leq w$)
    2. Consumption-based → Lucas 87
    3. Factor-based → This paper

- **Remark #2:** hypothetical vs. actual compensation
    - Valuation vs. compensation
    - Boadway 74 Paradox: actual compensations in GE are problematic
      Prices change in equilibrium after compensation

- **Remark #3:** Lucas 87 does not aggregate
    - Why? % of individual consumption
    - Histogram of individual gains and losses → fine ✓
    - Suggestion → % of aggregate consumption
      Explained in Davila/Schaab JPE 2025

Aggregate Productivity

Definition

$$A(\theta) \equiv \max \left\{ Z : \text{there is } c \in \underbrace{\mathcal{C}\left(\theta, \frac{1}{Z}\right)}_{\text{feasible allocations}} \text{ and } \underbrace{c_i}_{\text{alternative}} \underbrace{\succeq_i}_{} \underbrace{c_i(\theta)}_{\text{status quo}}, \forall i \right\}$$

- ▶ Aggregate Productivity : $A(\theta)$
  - ▶ Uniform factor contraction at alternative
  - ▶ Keeping everyone weakly better than status quo
    $A(\theta) > 1$: good, $A(\theta) < 1$: bad

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  1. with lump-sum transfers → most of the paper
     miraculous consensus, compensated representative agent
  2. with restricted transfers → most relevant

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1. Unit → "proportional uniform factors"
   Proportional is reasonable → why uniform across all factors?

2. Experiment → "CV-style"
   Compensation at alternative

- ▶ **Suggestion:** define and compute the EV-style counterpart

  "Minimum uniform factor expansion at status quo keeping everyone weakly better than alternative"

Example: "Stylized China Shock"

▶ Two individuals, each has linear technology with fixed factor

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▶ Contracting all technologies by 1.5 leaves 10 units to reshuffle

With transfers $\rightarrow$ target "aggregate level, then reshuffle"

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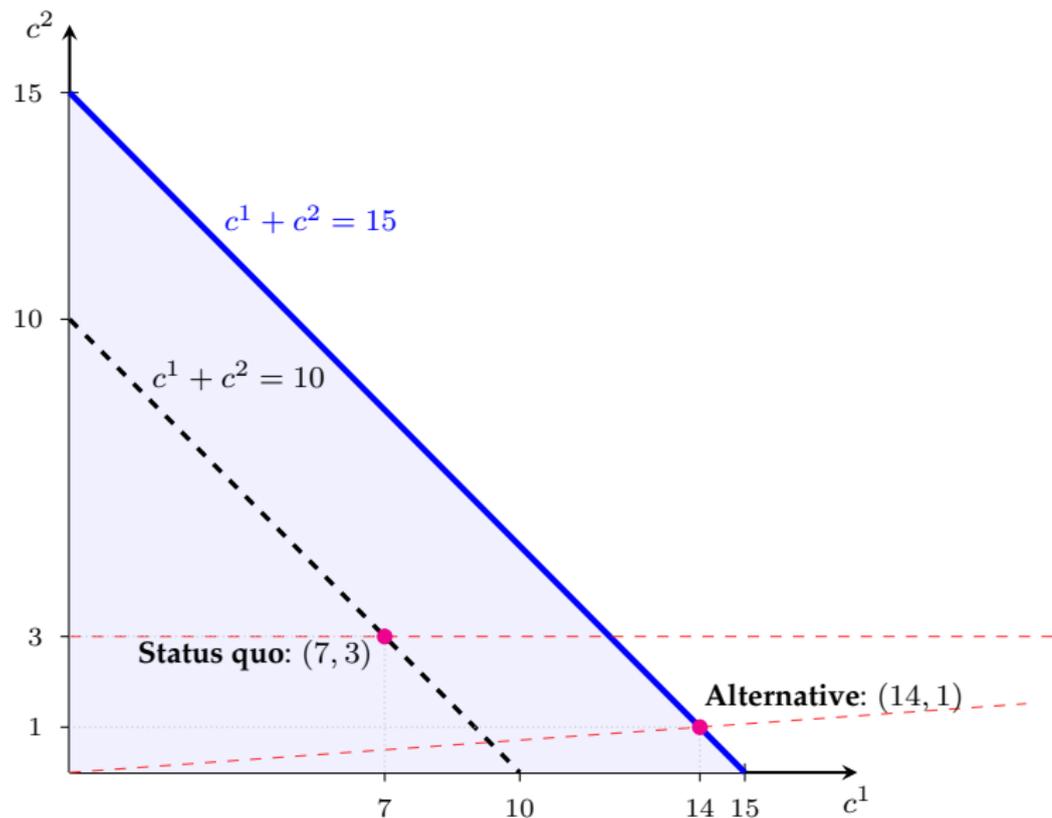3. Aggregate productivity <u>without</u> transfers:

$$A^1 = 14/7 = 2, \quad A^2 = 1/3 \quad \Rightarrow \boxed{A} = \min\left\{A^1, A^2\right\} = \boxed{1/3} \ (!!)$$

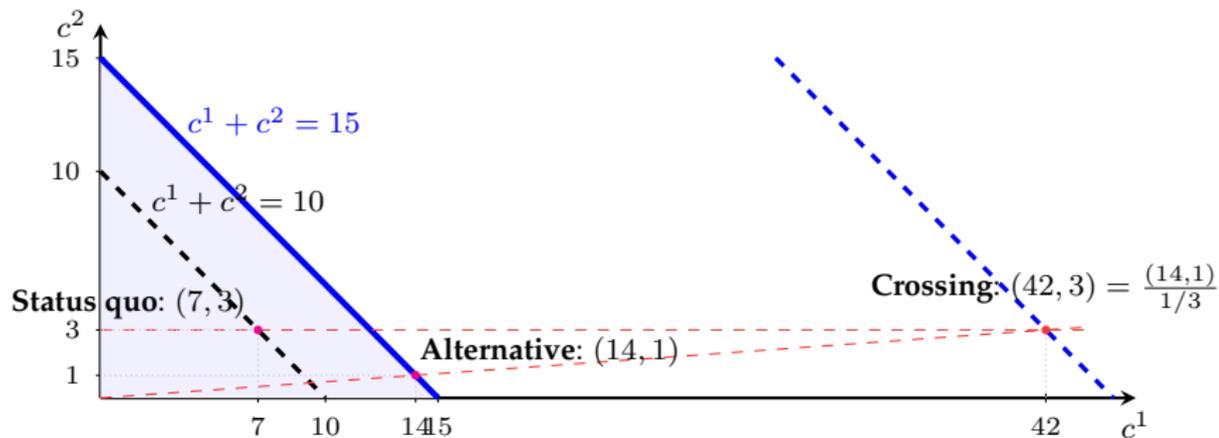   ▶ Contracting all technologies by $\frac{1}{3}$ leaves the losing agent indifferent

   Without transfers $\rightarrow$ driven by least favored individual (!) $\rightarrow$ Rawlsian

$\boxed{\text{Is this how we want to measure aggregate productivity?}}$

Example: "Stylized China Shock"

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Example: China Shock

Table 1: Effect of China Shock on the United States

Scenario	Immobile Factors		Mobile Factors	
	$\Delta \log A$	Δ Tariff (p.p.)	$\Delta \log A$	Δ Tariff (p.p.)
Tariffs & lump-sum transfers	0.008	+0.1	0.010	+0.3
Tariffs & targeted rebates	-0.010	+7.4	0.010	+0.4
Tariffs & non-targeted rebates	-0.179	+11.4	0.008	+1.6
Laissez-faire	-0.235	–	0.008	–

Tariff changes are expressed in percentage points.

▶ Restricted transfers → A turns negative
  Factor mobility spreads gains out
▶ Laissez-faire (no transfer) → driven by largest losers
  ▶ Who are they? Low skill

▶ **Remark**: *"This measure does not take a stance on how social surplus or losses should be divided among agents"*
  Every approach (implicitly or explicitly) must take a stance!
  ▶ With transfers → transfers go to least favored
  ▶ Without transfers → Rawlsian
    Measure shaped by least favored individual

Final Comments

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#1 Tension <u>implementing compensations</u>
Same argument applies to approaches with actual transfers

- ▶ If transfers are available at alternative, why not at status quo?
- ▶ Without transfers → determined by least favored
  - ▶ My preference: compute values and aggregate → do <u>not</u> compensate
- ▶ Transfers <u>should</u> be part of the "alternative"
  1. Status quo: no shock
  2. Alternative #1: China shock w/o transfers → Real world
  3. Alternative #2: China shock with transfers

#2 Aggregate Productivity is a <u>function of the status-quo</u>:
Same argument applies to (global) Kaldor-Hicks

$$A \left(\underbrace{\theta'}_{\text{alternative}} \; ; \; \underbrace{\theta''}_{\text{status quo}} \right) \neq A \left(\underbrace{\theta''}_{\text{alternative}} \; ; \; \underbrace{\theta'}_{\text{status quo}} \right)$$

- ▶ Ranking of alternatives may switch depending on status quo
  Challenges when used as global objective
- ▶ <u>Reversals</u> → similar to Scitovsky 41

Final Comments

#3 Aggregating vs. Dissecting Welfare Gains
- ▶ Why do welfare/productivity/efficiency gains materialize?
- ▶ "Origins of welfare gains" → Davila/Schaab 2025, 2026ab; BarconsDS 2025
- ▶ One aggregate measure vs. Explaining that measure

#4 Consumption-based welfare numeraires → fewer assumptions
- ▶ Valuation directly from individual
- ▶ Money or technology-based numeraires hinge on production or market assumptions
- ▶ Older version: based on consumption
  Consumption vs Factor-Based Numeraire

#5 Applicability to endowment/exchange economies?
- ▶ Example with incomplete markets
- ▶ Older version: Aggregate-*Efficiency* vs Aggregate-*Productivity*

#6 It would be useful to include more comparisons to Kaldor-Hicks
- ▶ With and without implementing compensations
- ▶ In specific scenario → e.g. China Shock

Conclusion

- New measure of aggregate productivity with heterogeneous agents
- Interesting alternative to Kaldor-Hicks
  - More so with <u>implementable</u> lump-sum transfers
  - Less so without $\rightarrow$ driven by <u>least favored</u>

- I enjoyed reading the paper!

Thank you for your attention