Discussion of

Industrial policies for multi-stage production: The battle for battery-powered vehicles

(Head, Mayer, Melitz, Yang)

Trade, value chains and financial linkages in the global economy

BDI / ECB / WB

November 2024

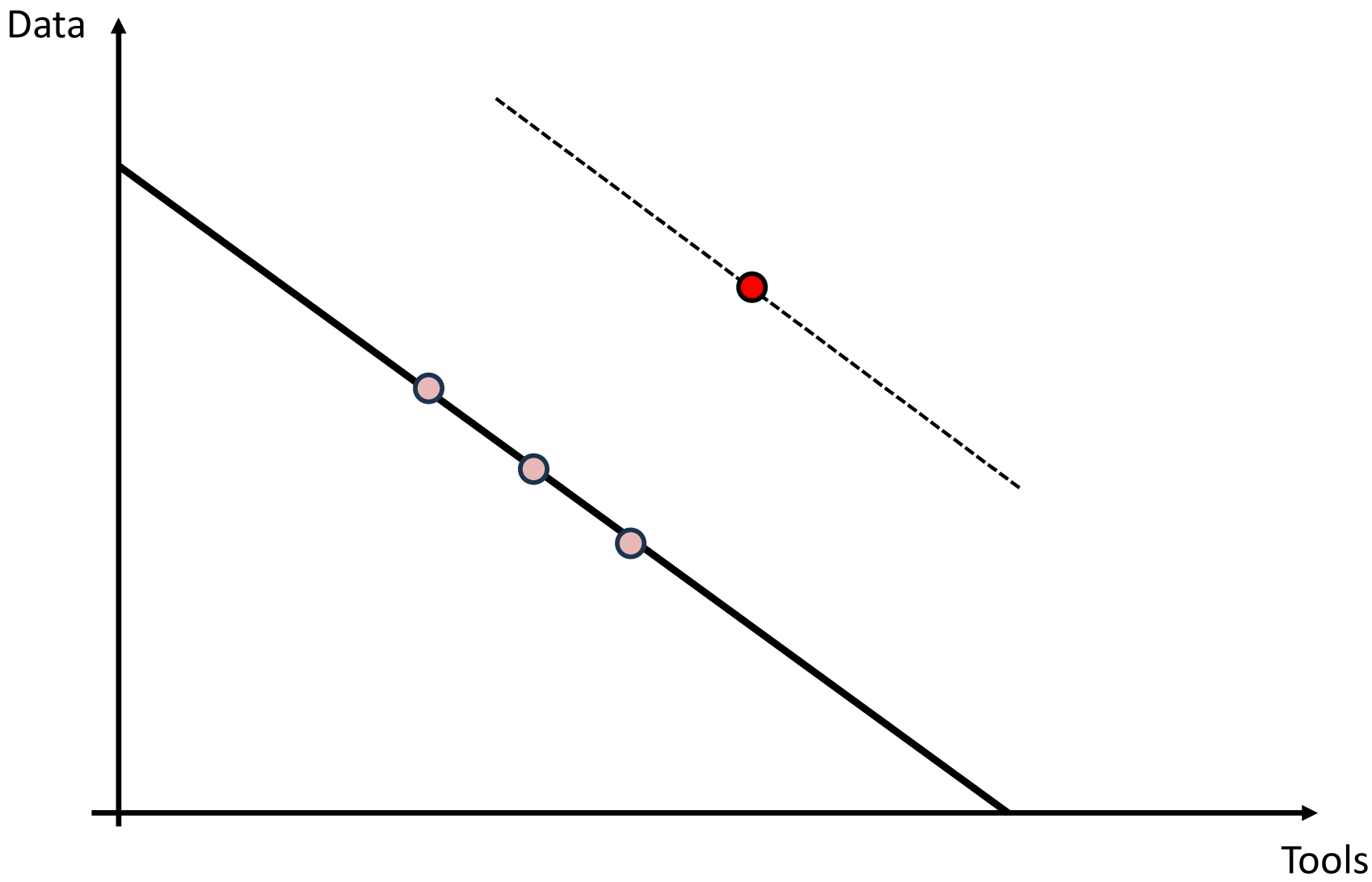
Rocco Macchiavello
LSE

Summary

- This paper develops a quantitative method to analyse industrial policies for multi-stage production and applies it to the EV industry

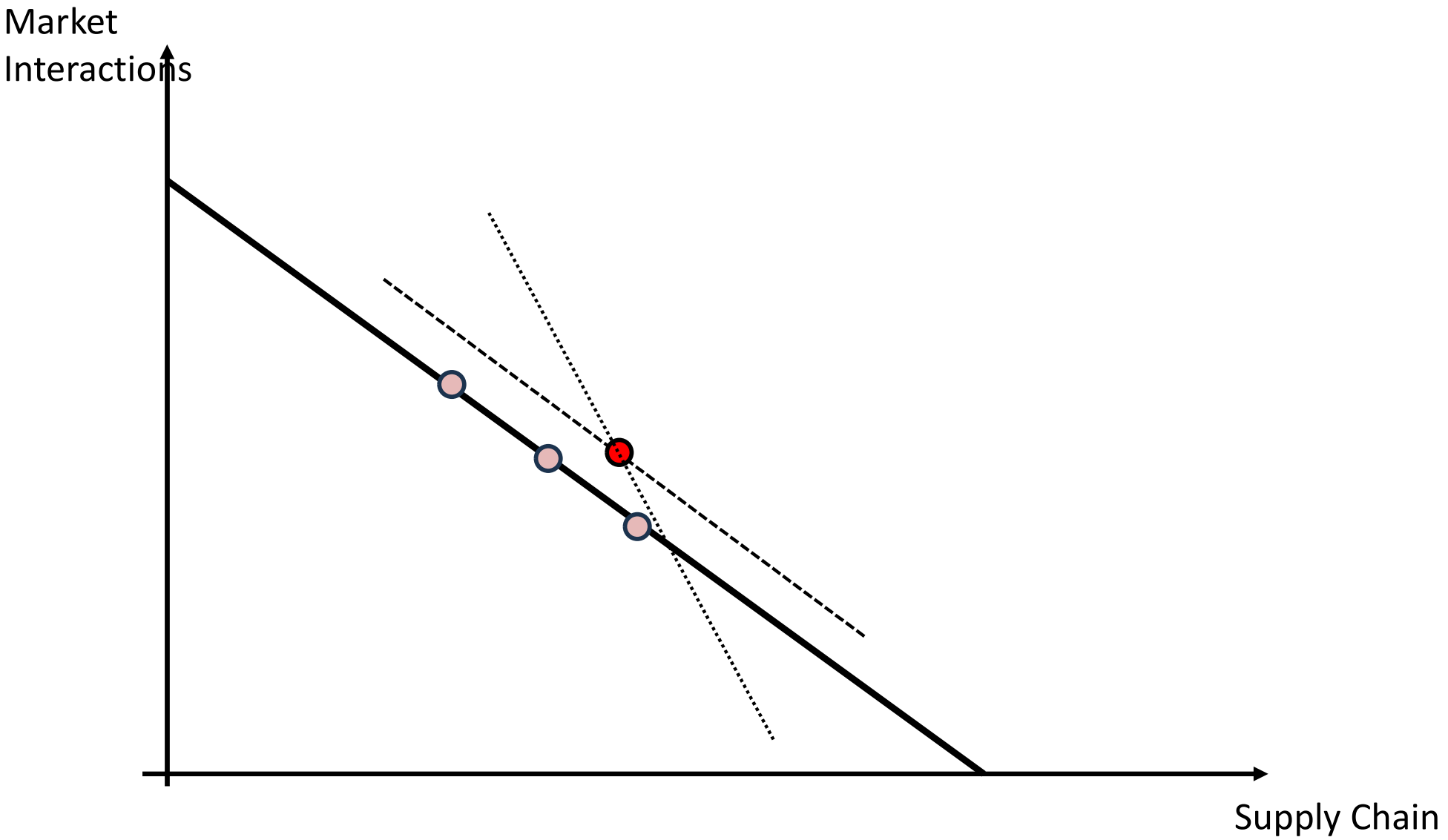
Contribution I

- This paper ***develops a quantitative method to analyse industrial policies for multi-stage production*** and applies it to the EV industry



Contribution II

- This paper develops a quantitative method to analyse industrial policies for multi-stage production and ***applies it to the EV industry***



My 2 cents on

- This paper ***develops a quantitative method to analyse industrial policies for multi-stage production*** and applies it to the EV industry

Methodological Contribution

- Impressive. This is front-stage: related literature *only* discusses methodological contribution w/out *any* discussion of IP, EV, and IP for EV literatures.

- There surely is an important contribution but I am not qualified to provide substantial suggestions on the model/algorithm implementation.

Methodological Contribution

- Impressive. This is front-stage: related literature *only* discusses methodological contribution w/out *any* discussion of IP, EV, and IP for EV literatures.

- There surely is an important contribution but I am not qualified to provide substantial suggestions on the model/algorithm implementation.

- Help a(n uninformed) reader in appreciating the contribution

  Section 4:

  - Discussion of literature in intro refers to *interdependencies*, *sub*- and *super*- modularity. Is it worth formally defining these concepts in the context of your model?
  - Does your model nest models in the literature? You could be explicit about which dimensions it generalizes existing models. (Maybe even deploy your algorithm to solve those simpler models)

Methodological Contribution

- Impressive. This is front-stage: related literature *only* discusses methodological contribution w/out *any* discussion of IP, EV, and IP for EV literatures.

- There surely is an important contribution but I am not qualified to provide substantial suggestions on the model/algorithm implementation.

- Help a(n uninformed) reader in appreciating the contribution

  Section 4:

  – Discussion of literature in intro refers to *interdependencies*, *sub-* and *super-* modularity. Is it worth formally defining these concepts in the context of your model?

  – Does your model nest models in the literature? You could be explicit about which dimensions it generalizes existing models. (Maybe even deploy your algorithm to solve those simpler models)

  Section 5:

  – Currently it shows that the approach *is* feasible in a demanding environment ("*it can be done, but results are complex*")

  – This invites the reader to be skeptical about policy counterfactuals later on.

  – Would exploring *a continuum* of simulations illustrate how [some] key parameters matter? Maybe you could do that with the simpler model you eventually take to the data.

  – This would help the reader build [some] intuition and might be cheaper than tackling the robustness of counterfactuals to estimates.

My 2 cents on

- This paper develops a quantitative method to analyse industrial policies for multi-stage production and ***applies it to the EV industry***

Taking the Model to the Data

- The data are impressive and novel.
  - Under mild assumptions, it allows us to track the supply chain (location, factory) for many EVs across multiple stages and countries. I *really* like this aspect.
  - [More generally: enormous gains from global industry studies in btw IO & Trade]

- It seems an important computational constraint is the sheer number of potential *paths* a firm could choose from to optimize
  - The authors make very sensible choices once they get to estimation

- There is not a lot of discussion of whether the potential sets of paths available to a firm could be more limited in practice
  - MNCs entry & location decisions process
  - Path-dependency
  - … ?

- (Other data might also be useful for validation/estimation)

Estimation

- There is a lot to absorb here. What I understood:
  a. Taking entry in market *n* as given, we focus on the choice of path – i.e., sourcing choice for the two stages (assembly, battery)
  b. The probability of a given path can be expressed as the product of the conditional probabilities at each stage.
  c. In turn, each of those, is a function of variable and fixed costs at that stage.
  d. In a first step, we can estimate the probability of each stage separately. This yields estimates for the variable costs.
  e. In the second step, SMM can be used to recover also the fixed costs.

- Assumptions required to go c. → d. not entirely clear to me. It would be helpful perhaps to spend a bit more time there.
  – Is the idea that the bilateral fixed-effects for origin and destination at the relevant stage absorb the fixed costs (?)

- I *really* liked benchmarking of cells' cost share to industry "*estimates*" (even s.t. caveat). Can "insider" knowledge be leveraged more systematically?
  – E.g., as constraints/targets to estimate the model, or for validation.

Taking the Model to the Industry

- The tool developed in the paper can be applied to (*m*)*any* industry.

- For example, a great fit for the apparel industry:
  - Brands selling in multiple countries, deciding where to do design, and de-localize production,
  - Many buyers, infinitely many suppliers,
  - Industry in stead-state, little technological change & dynamic learning effects

- But is this a good model for the EV industry?
  - *Some* stylized facts consistent with the model. However …

EV

Table 5: 15 top firms in 2022

No.	Manufacturer	# Markets	# Models	Sales Cum. Share (%)	Sales-exCHN Cum. Shr (%)
1	Tesla	23	4	20.5	28.0
2	Volkswagen	24	23	30.0	42.4
3	Hyundai	23	15	35.6	54.1
4	Stellantis	18	19	40.3	63.7
5	BMW	24	7	44.0	69.7
6	Renault	19	6	46.7	75.3
7	Mercedes-Benz	24	9	49.3	80.0
8	Geely	24	15	55.6	84.4
9	Ford	22	4	57.5	88.3
10	Nissan-Mitsubishi	23	8	60.1	91.9
11	SAIC	17	21	72.8	95.0
12	General Motors	7	7	74.1	96.6
13	Toyota	23	8	74.9	97.8
14	Rivian	3	3	75.3	98.6
15	BYD	10	14	89.6	98.9

Note: Market shares defined over 24 countries used in simulations.

- In-sample global ***HHI*** ≈1375 (***C4*** 63.7)
- In US, ***HHI*** (used to be) >2500, in EU ***HHI*** >1000 (***C4*** ≈54)
- Concentrated market, with substantial dynamic
- Batteries (and patents on batteries) even more concentrated

Taking the Model to the Industry

- The tool developed in the paper can be applied to (*m*)*any* industry.

- For example, a great fit for the apparel industry:
  - Brands selling in multiple countries, deciding where to do design, and de-localize production,
  - Many buyers, infinitely many suppliers,
  - Industry in stead-state, little technological change & dynamic learning effects

- But is this a good model for the EV industry?
  - *Some* stylized facts consistent with the model. However …
  - EV industry is (quite) highly concentrated at both stages (autos, batteries) → bilateral oligopoly
  - Industry clearly not in steady state: motivating facts confirm this.
  - Massive technological progress on **batteries**
  1. Cost of batteries is rapidly declining
  2. Battery quality (milage, charging times, safety) will determine who wins the race!

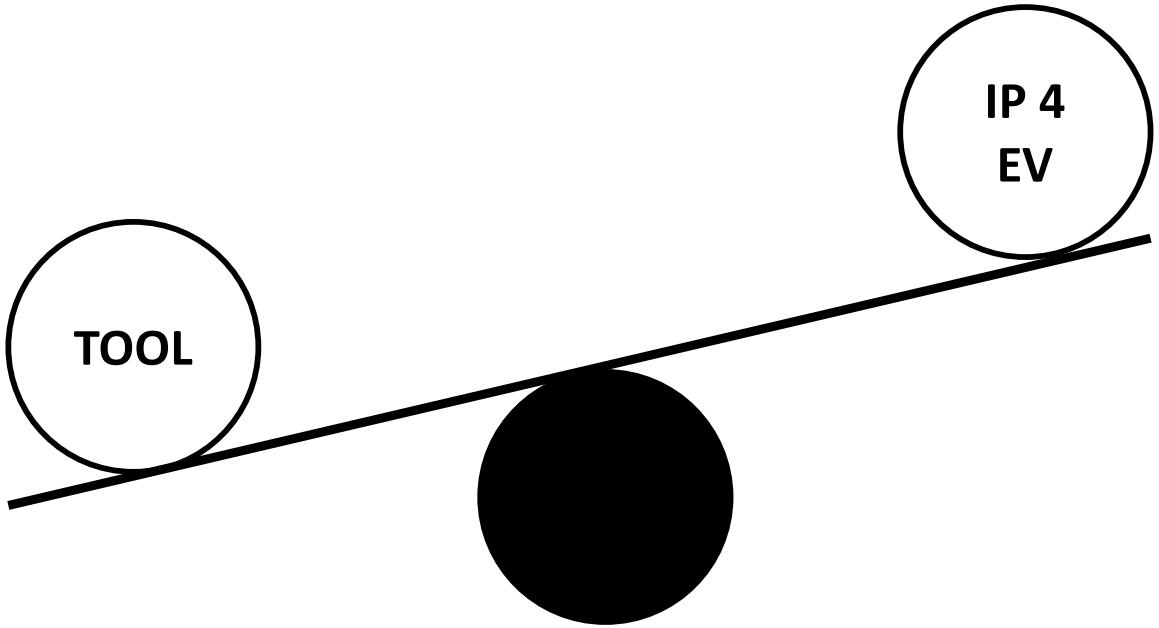
- Maybe discuss a bit more the trade-offs involved in modelling choices + possibly implications for the evaluation of policy counterfactuals.

In the end …

- Impressive paper that brings new tools and applies them to one of the defining IP questions of our time

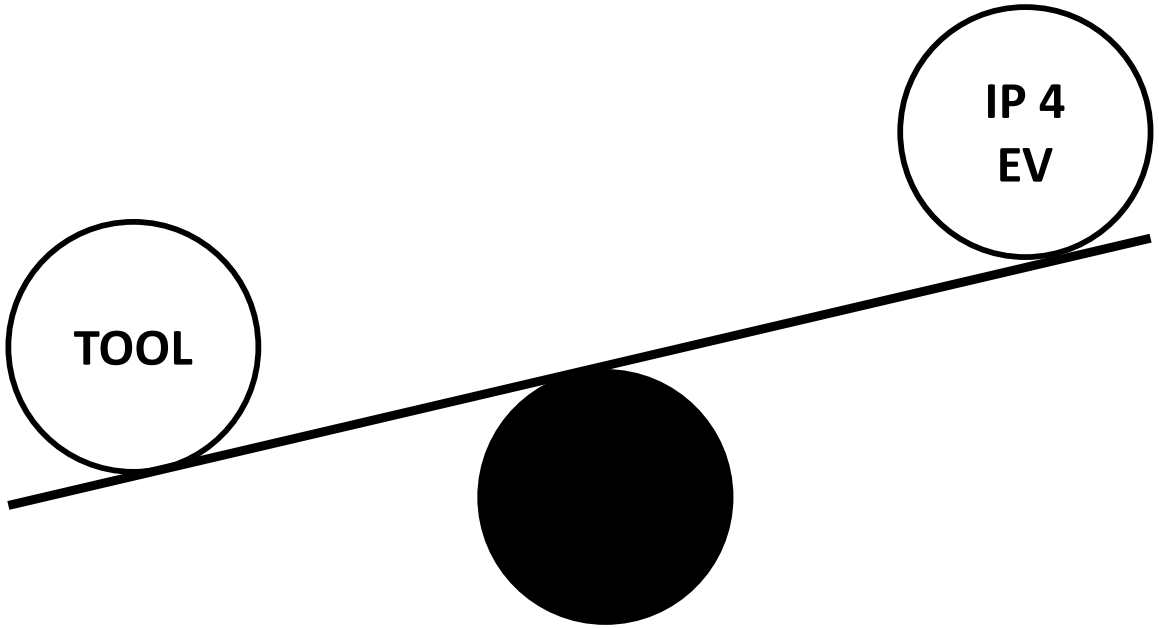
In the end …

- Impressive paper that brings new tools and applies them to one of the defining IP questions of our time
  - Main challenge is that both tool and application need lot of real estate



In the end …

- Impressive paper that brings new tools and applies them to one of the defining IP questions of our time
  - Main challenge is that both tool and application need lot of real estate



- We need more work like this at the intersection of trade & IO

R.Macchiavello@lse.ac.uk

Thank you!